Compressed Air Magazine

MAY 1955

EXCELLENT VIEW OF HOOVER DAM

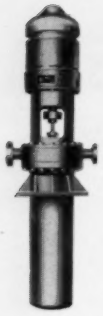
Recent aerial photo reveals low level of Lake Mead owing to long drought

PHOTO FROM COLORADO RIVER AQUEDUCT NEWS

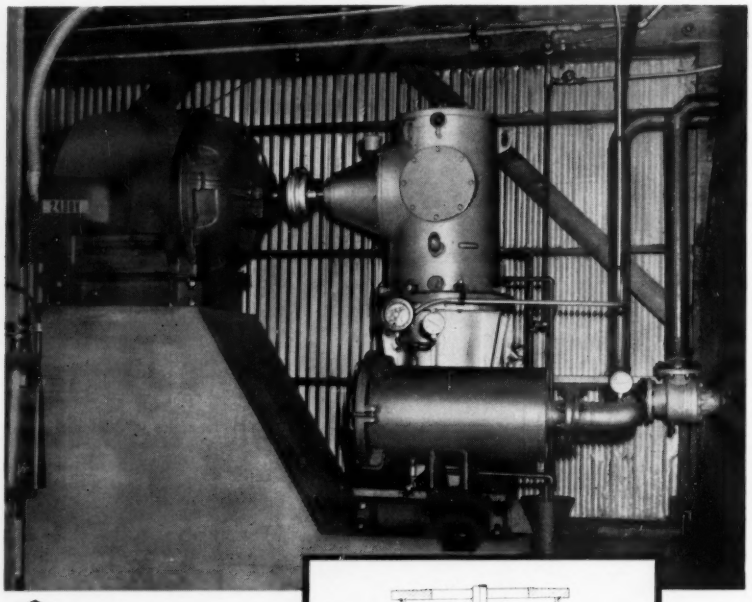
VOLUME 60 • NUMBER 5

NEW YORK • LONDON

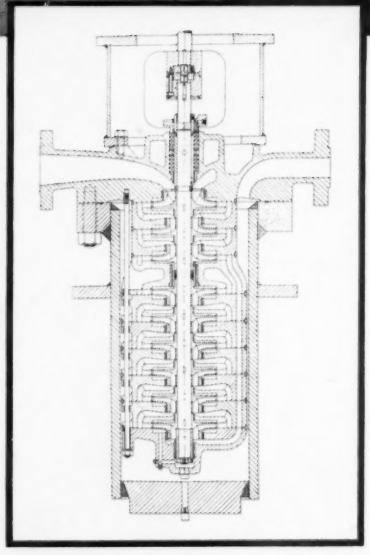
I-R multi-stage vertical pump provides 1500 lb. pressure for LOG DEBARKING



at HARRIS PINE MILLS



Ingersoll-Rand 11-stage Class VHTB pump in hydraulic debarking service at Harris Pine Mills, Pendleton, Oregon. Driven by a right-angle speed-increasing gear at 4400 rpm, this unit is rated 350 gpm, 1500 psi discharge. Intake strainer is shown in lower foreground.



Cross-section of Class VHTB pump. Each stage consists of impeller, combined diffusor and channel piece, and renewable wearing ring. Since each stage is a complete pump in itself, the design is extremely flexible and readily adaptable to a wide range of operating conditions.

IN stripping the Bark from lumber mill logs the hydraulic method saves much time and effort. But it's tough service for pumps—requiring high pressure as well as dependability and freedom from costly shutdowns of the debarking operation.

At Harris Pine Mills, in Pendleton, Oregon, the Hansel Engineering Company solved the problem satisfactorily with the installation of an Ingersoll-Rand Class VHTB 11-stage centrifugal pump. This vertical-type unit delivers 350 gallons of cold water per minute at 1500 lb. It is motor driven through a right-angle step-up gear which gives the pump an operating speed of 4400 rpm.

In the VHTB pump, there is no radial load on the shaft; and hydraulic axial thrust is reduced to a minimum by the opposed arrangement of the impellers. Piping connections are straight through and in-line, and there is only one stuffing box. These factors contribute to exceptional dependability as well as ease of installation and servicing. Ask for I-R pump specialist for complete details, or write for Bulletin No. 7096.

Ingersoll-Rand

Cameron Pump Division
11 Broadway, New York 4, N. Y.

10-141

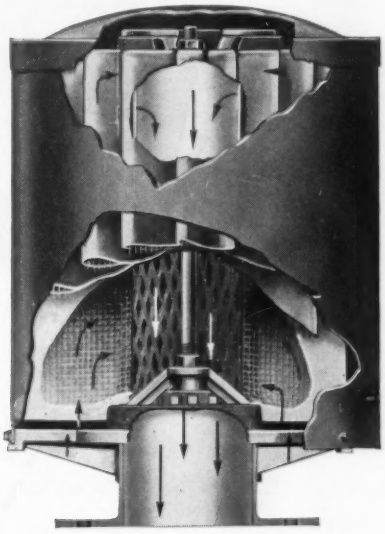
GAS & DIESEL ENGINES • AIR & ELECTRIC TOOLS • COMPRESSORS • PUMPS • TURBO-BLOWERS • VACUUM EQUIPMENT

Circle 1A on reply card

"LET'S SPECIFY STAYNEW INTAKE FILTERS

They give us positive protection . . . They won't need regularly scheduled maintenance . . . They're easy to clean on the job . . . Efficient over a wide range of loads . . . They're not affected by temperature change . . . There's no oil carry-over

OUR EQUIPMENT WILL LAST LONGER!"



MODEL D
Intake Filter

Industrial engineers everywhere know that Staynew's *Positive Protection* lengthens equipment life. From compressors to generators . . . from blowers to internal combustion engines, Staynew Intake Filters stop dust and dirt from entering through air intakes, causing carbon accumulation and needless wear. And Staynew Filters frequently operate two or more years *without maintenance.* When cleaning is indicated, a brush or simple vacuum cleaning tool is all you need. Specify Staynew and increase productive time.

Write for Complete Booklet on Staynew Intake Filters.

Representatives in Principal Cities

DOLLINGER REG. PROTECTOMOTOR U.S. PAT. OFF. STAYNEW FILTERS

DOLLINGER CORPORATION

7 Centre Pk., Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

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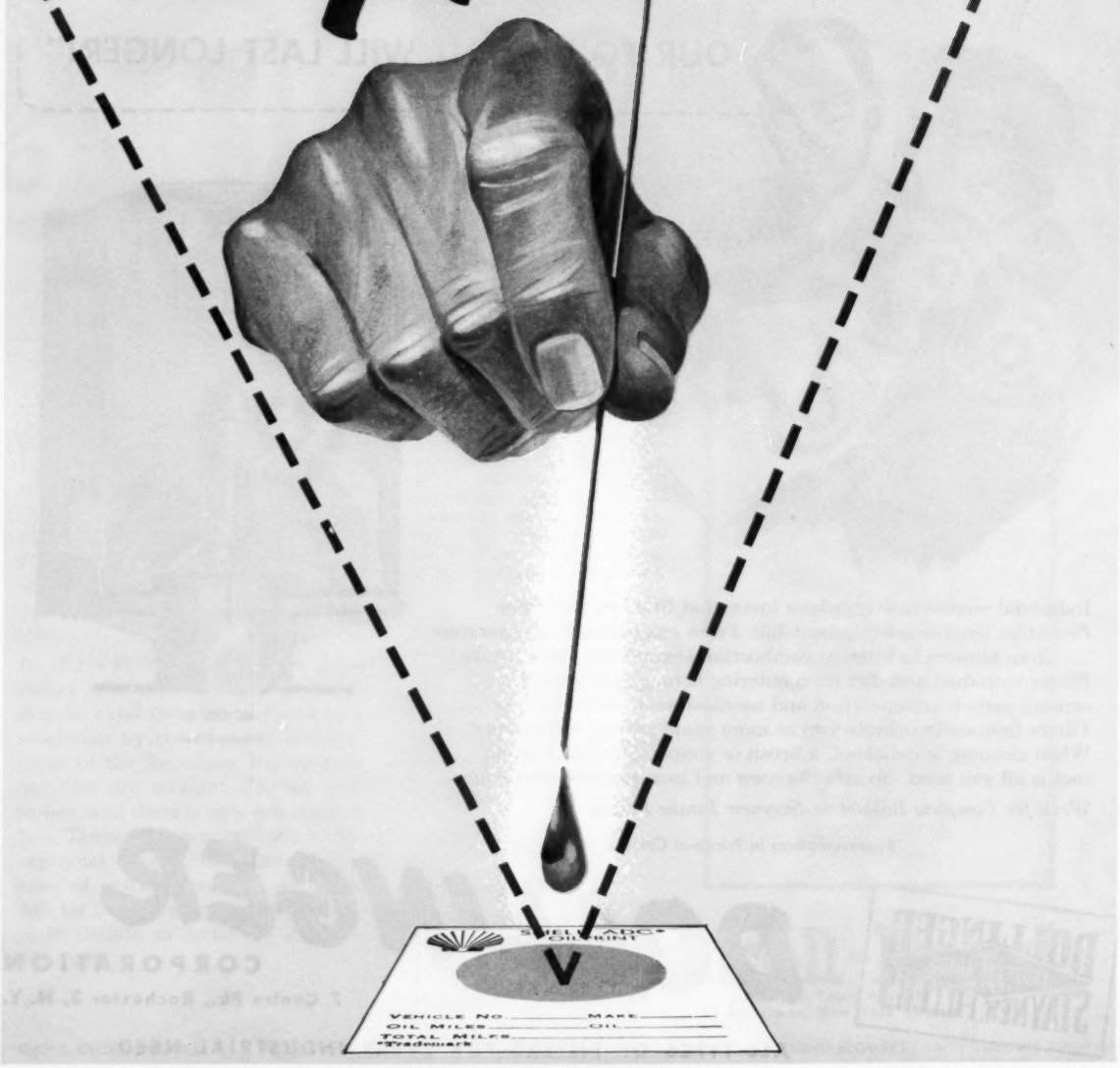
DIESEL AND GASOLINE ENGINE OPERATORS

A NEW PM TOOL



ADC* Oilprint Analysis

CHECKS CRANKCASE OIL IN MINUTES

Shell Research gives you new oil-change yardstick—

Now—operators can test crankcase oil in the short time allotted for refueling and crankcase oil checks. The Shell ADC Oilprint Analysis gives a practical and accurate oil evaluation in minutes.

ADC Oilprint Analysis means big savings when used in your preventive maintenance program . . . gives valuable information on engine and oil conditions. It answers the question "When do I change my oil?" thus eliminating the draining of usable oil and the risk of using oils loaded with contaminants.

See for yourself how the new Shell ADC Oilprint Analysis can save you money in preventive maintenance. Let us show how you can use this new service for your equipment.

SAVES... Time, Money, Engines, Oil

*Trademark

SHELL OIL COMPANY,

50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

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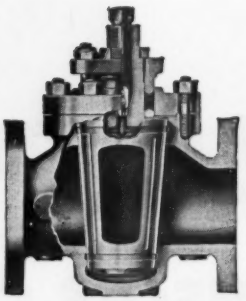
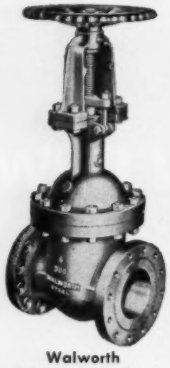
● VALVES

● PIPE FITTINGS

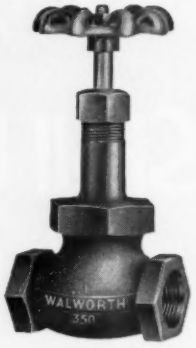


Walworth
Lubricated Plug Valve



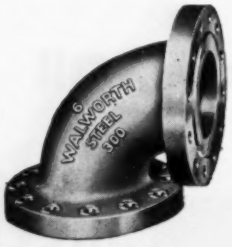
Walworth
Steel Gate Valve

Walworth
Iron Body Gate Valve



Walworth
"500 Brinell" Bronze Globe Valve

Walworth
Iron Body Saddle Gate Valve



Walworth
Cast Steel Flanged Fittings

Walworth manufactures a *complete line* of valves and pipe fittings: all made to the highest standards of quality, both as to dimensional accuracy and metallurgical properties. In design, construction, and performance, Walworth products reflect more than a century of experience in the manufacture of quality valves and fittings.

Your Walworth distributor will give you full information on the *complete line* of Walworth steel, iron, and bronze, and special alloy valves and pipe fittings; also Walworth Lubricated Plug Valves, and Walseal* valves, fittings and flanges. Ask for this information today.

*Patented—Reg. U. S. Pat. Off.

WALWORTH

valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

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FACT: The new Life-Line A has stronger insulation than any motor on the market

Meaning what? Simply that the new Westinghouse Life-Line® "A" motor with new *fortified insulation* can withstand heavier overloads and operate at higher temperatures than any other motor you can buy. That's electrical system improvement!

There are equally important advances in the Life-Line "A" mechanical and lubrication systems. It takes the right combination of *all three systems* to build industry's most preferred "power package".

Westinghouse builds a complete line of motors from 1 to 700 hp for compressor applications everywhere. Get all the facts from your Westinghouse sales engineer—The Man With The Facts. J-21894

YOU CAN BE SURE... IF IT'S Westinghouse

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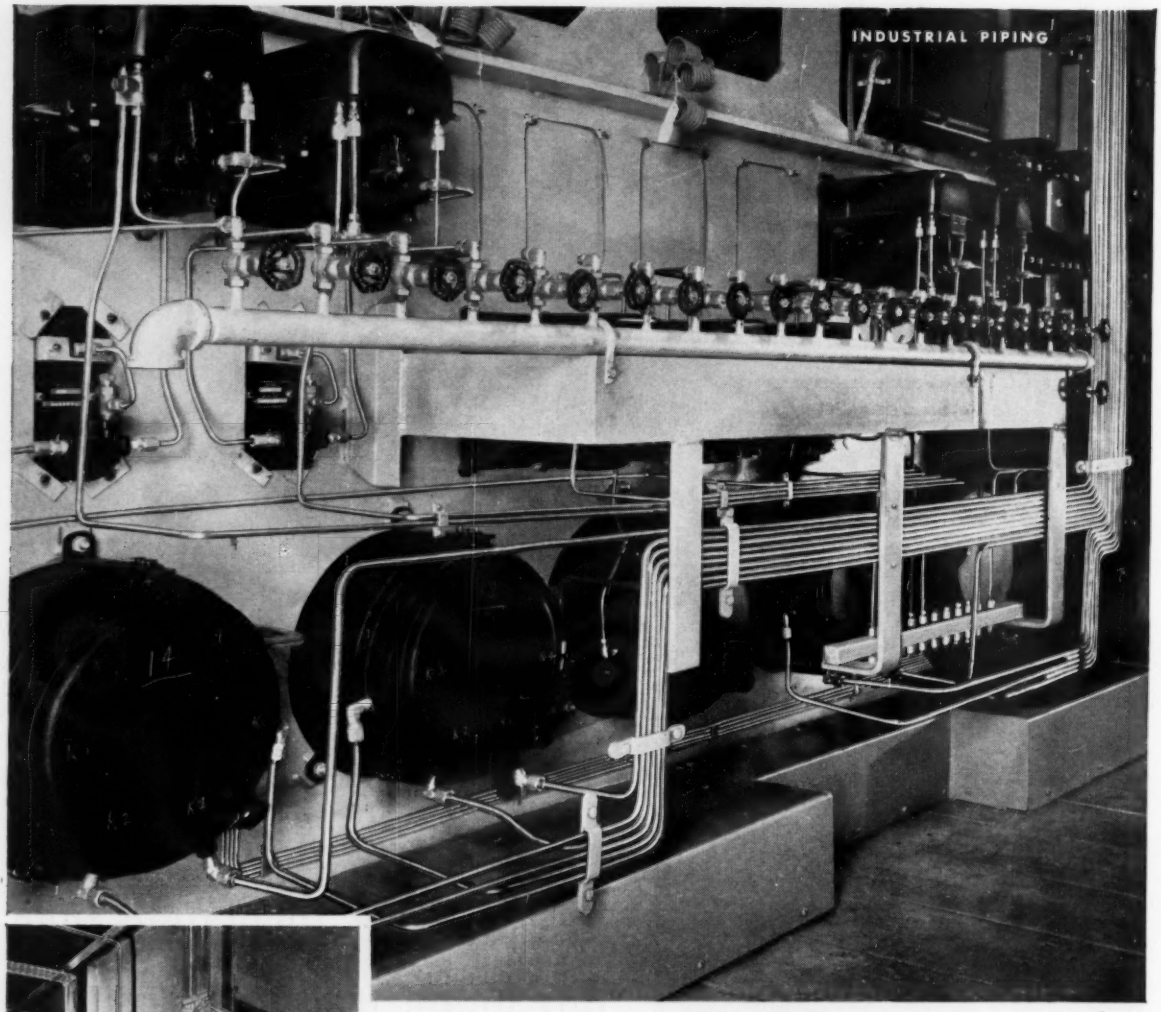
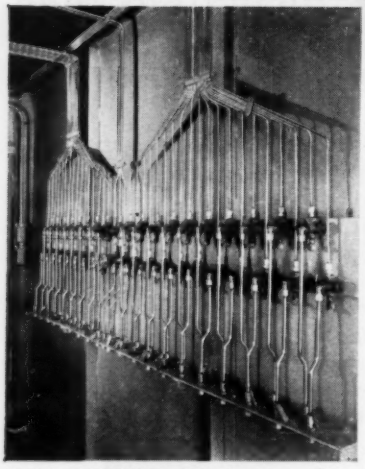


THESE AIR SIGNAL LINES in Toronto's Richard L. Hearn Power Station use copper tube in long lengths, change direction and avoid obstructions without fittings.



MOIST COMPRESSOR AIR can never form rust or scale to impede control in this installation made by Bailey Meter Co., Ltd.

Wet air can't rust this copper control piping

CONTROL would be impaired if moisture could create rust or scale in these pneumatic control lines for coal-pulverizing equipment installed by Bailey Meter Company, Limited, in Toronto's Richard L. Hearn Power Station. A number of these copper tubes convey differential pressures to the pulverizer feeder controllers, while others transmit an air signal to the pulverizers to selectively limit the rate of coal feed. Rust particles which might interfere with the satisfactory operation of the control system cannot form, and the smooth bore keeps flow resistance at a minimum.

Here, as in all copper tube systems, the long lengths, the light weight and the elimination of many fittings by bending all make important savings in installation costs. Where flare or solder-type fittings are used, there are no threads to cut, and connections stay tight.

Publication C-24 offers many additional facts on how ANACONDA Copper Tubes can help improve product quality, reduce operating and maintenance costs and avoid costly shutdowns. Write to: *The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.* 5330A

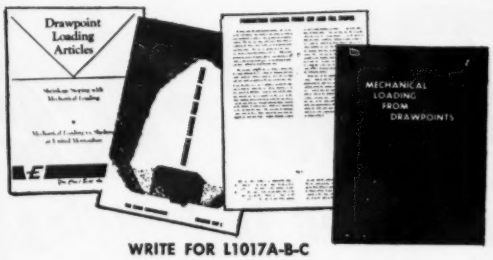
call your

ANACONDA®

distributor for

Copper tubes and fittings for industrial process lines, water, heating and sanitary drainage systems; American Flexible Metal Hose and Tubing; American Vibration Eliminators.

PRODUCTION LOADING WITH EIMCOS WILL SAVE YOU MONEY



WRITE FOR L1017A-B-C

THESE BULLETINS WILL TELL YOU HOW AND WHY

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Texas Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Pasadena, Calif. Houston, Texas London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

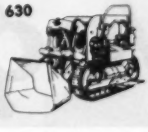
B-101

40-H

12-B

21

630



Circle 7A on reply card

186,072,500

pounds of Tube-Ice

used in building

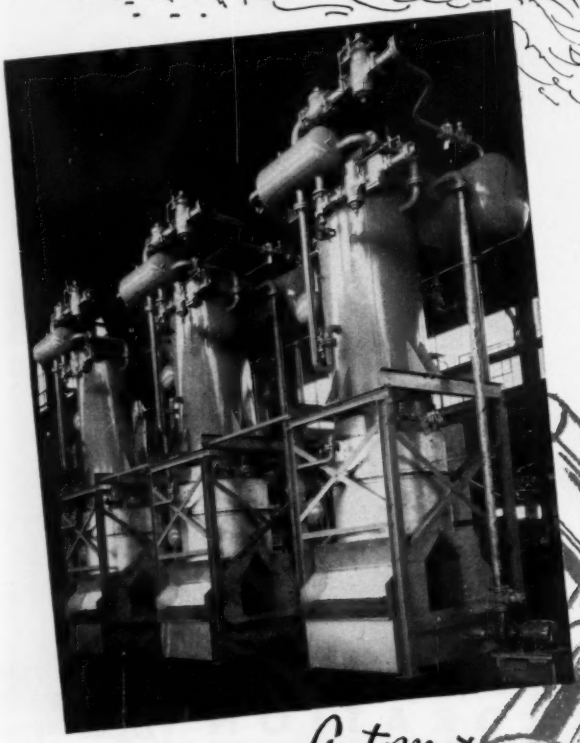
2 WESTERN DAMS*

Yes—that much ice was required to cool the concrete mix in order that it set properly to develop its ultimate strength for two outstanding dam structures.

The important part of this message to you is that the compact and readily portable Vogt Tube-Ice Machines pictured here set this record without even the replacement of a freezer tube. What's more, they are *ready to go again* whenever ice is needed in quantity.

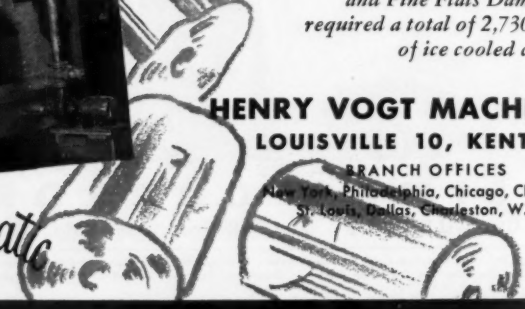
Tube-Ice is widely used in process work and for preserving shipments of meat, fish, milk or vegetables . . . and is produced at the lowest possible cost per ton since a Tube-Ice unit occupies less space, has fewer parts, uses less power than any other method for making ice.

Tube-Ice Machines are available in sizes from 2000 lbs. per day up to any desired capacity. Send for free Bulletin TI-3.



**McNary Dam, Washington, and Pine Flats Dam, California, required a total of 2,730,000 cu. yds. of ice cooled concrete mix.*

HENRY VOGT MACHINE CO.
LOUISVILLE 10, KENTUCKY
BRANCH OFFICES
New York, Philadelphia, Chicago, Cleveland, St. Louis, Dallas, Charleston, W. Va.



Automatic

Vogt TUBE-ICE MACHINE

Circle 8A on reply card

Circle 9A on reply card

Contract work on the Niagara River Remedial Project was directed by the district engineer of the Buffalo District, Corps of Engineers, U. S. Army.

Wire Rope at Work—Recently Norman H. McLain, Buffalo contractor, undertook the formidable task of diverting a portion of the swift Niagara River, just above the Falls. His was the job of exposing—temporarily—many acres of riverbed so that thousands of cubic yards of rock could be removed. Purpose: to create a more uniform distribution of water over Horseshoe Falls and thereby check the severe erosion at the center of the crest.

In constructing his diversion dam, McLain first erected a shield that was held in place by Bethlehem wire ropes, anchored upstream. In addition, to prevent lateral drift, a separate cable was run from the shield to a nearby point of land. This device, secured by the strong steel ropes, made it possible to construct the temporary dam, section by section, and thus assure successful completion of the project.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem rope for the following industries and numerous others:
CONSTRUCTION • MINING • PETROLEUM • EXCAVATING • QUARRYING • LOGGING • MANUFACTURING

CONTRACTORS: THIS IS IT!

The revolutionary NEW three-way

DRILLMASTER

...the only completely self-contained, self-powered drilling rig that combines these three advanced rock drilling methods

Here in one completely integrated package is a totally new "three-way" rock drilling machine designed to speed up work and provide a range of hole sizes and drilling depths heretofore not available in a blast hole drill. The versatile Ingersoll-Rand Drillmaster embodies three combinations or methods of drilling.

Combination one utilizes the new revolutionary DEPTH-MASTER or "down the hole" drill for deep blast holes up to 6" in diameter.

Combination two is available with the POWER-MASTER, a new heavy-duty hammer drill for 4¼" holes.

Combination three with the ROTO-MASTER rotary drill is ideal for rotary drilling for hole sizes up to 6¼". You can buy any one or all three of the drilling combinations to suit your own requirements.

Never before has there been a rock drilling machine that offered so much for blast hole drillers. The Drillmaster's versatility (three ways of drilling), its independent rotation, and long wearing Ingersoll-Rand Carset Bits will give you faster and cheaper drilling in any kind of rock.

Whatever your rock drilling problem, consult your Ingersoll-Rand representative. His experience is yours for the asking. Ask him or write direct for informative Drillmaster Bulletin Form 4164.

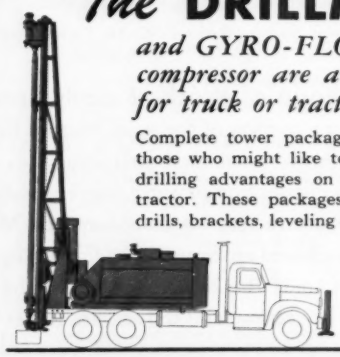
Ingersoll-Rand

5-155 11 Broadway, New York 4, N. Y.

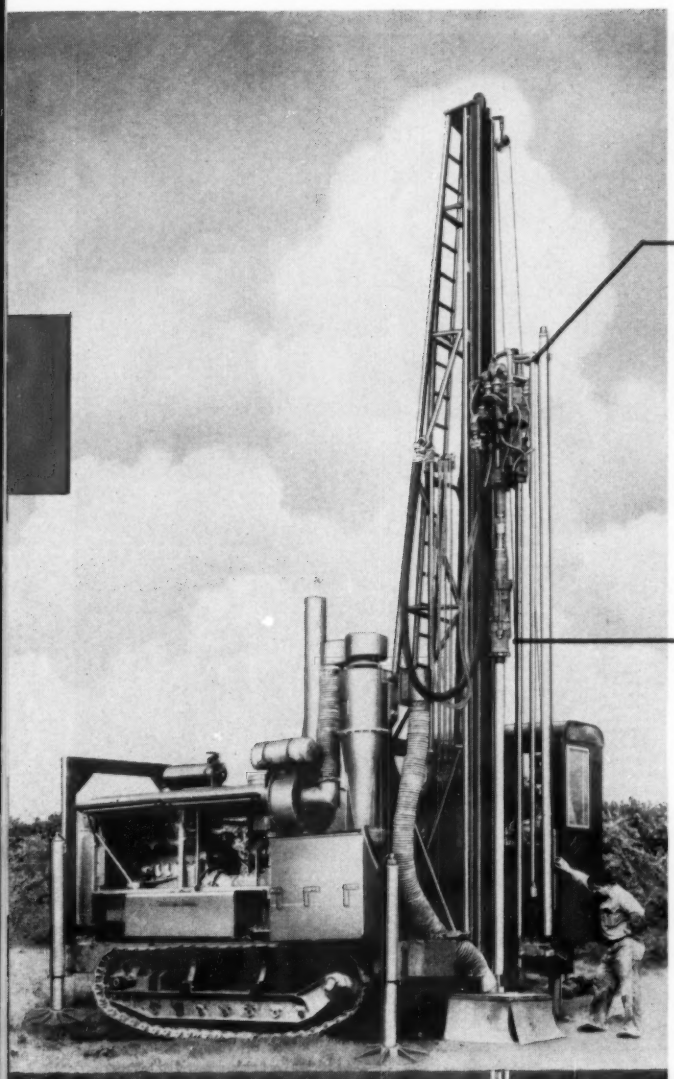
The **DRILLMASTER**

and GYRO-FLOW 600 compressor are available for truck or tractor mounting

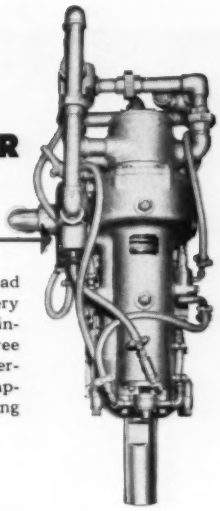
Complete tower packages are available for those who might like to utilize Drillmaster drilling advantages on their own truck or tractor. These packages include the tower, drills, brackets, leveling devices and controls.



ROCK DRILLS • COMPRESSORS • PUMPS • AIR TOOLS • OIL & GAS ENGINES • CONDENSERS

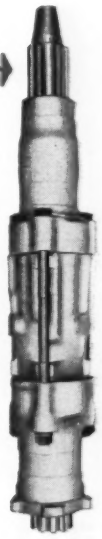


ROTO-MASTER
"rotary drill"



This powerful rotary drill head is standard equipment on every Drillmaster and supplies the independent rotation for all three methods of drilling. This powerful independent rotation is appreciated by all when drilling tight or broken ground.

POWER-MASTER
"out-of-the-hole drill"



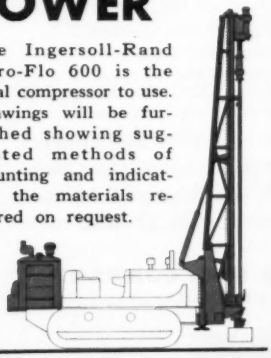
The Power-Master, a new extra heavy-duty hammer drill is the most powerful machine in its class. It provides the fastest drilling combination for 4¼" holes to 60 ft. in depth, making it second to none for construction work. It utilizes long wearing Carset Bits on proven Ingersoll-Rand rods and threads.

DEPTH-MASTER
"down-the-hole drill"

In this truly outstanding contribution to rock drilling the drill actually goes down the hole with the bit – No energy is lost in long heavy drill steels and much deeper blast holes are possible than with hammer drills. Rotation is provided by the Roto-Master and 6¼" Carset Bits are used.

TOWER

The Ingersoll-Rand Gyro-Flo 600 is the ideal compressor to use. Drawings will be furnished showing suggested methods of mounting and indicating the materials required on request.



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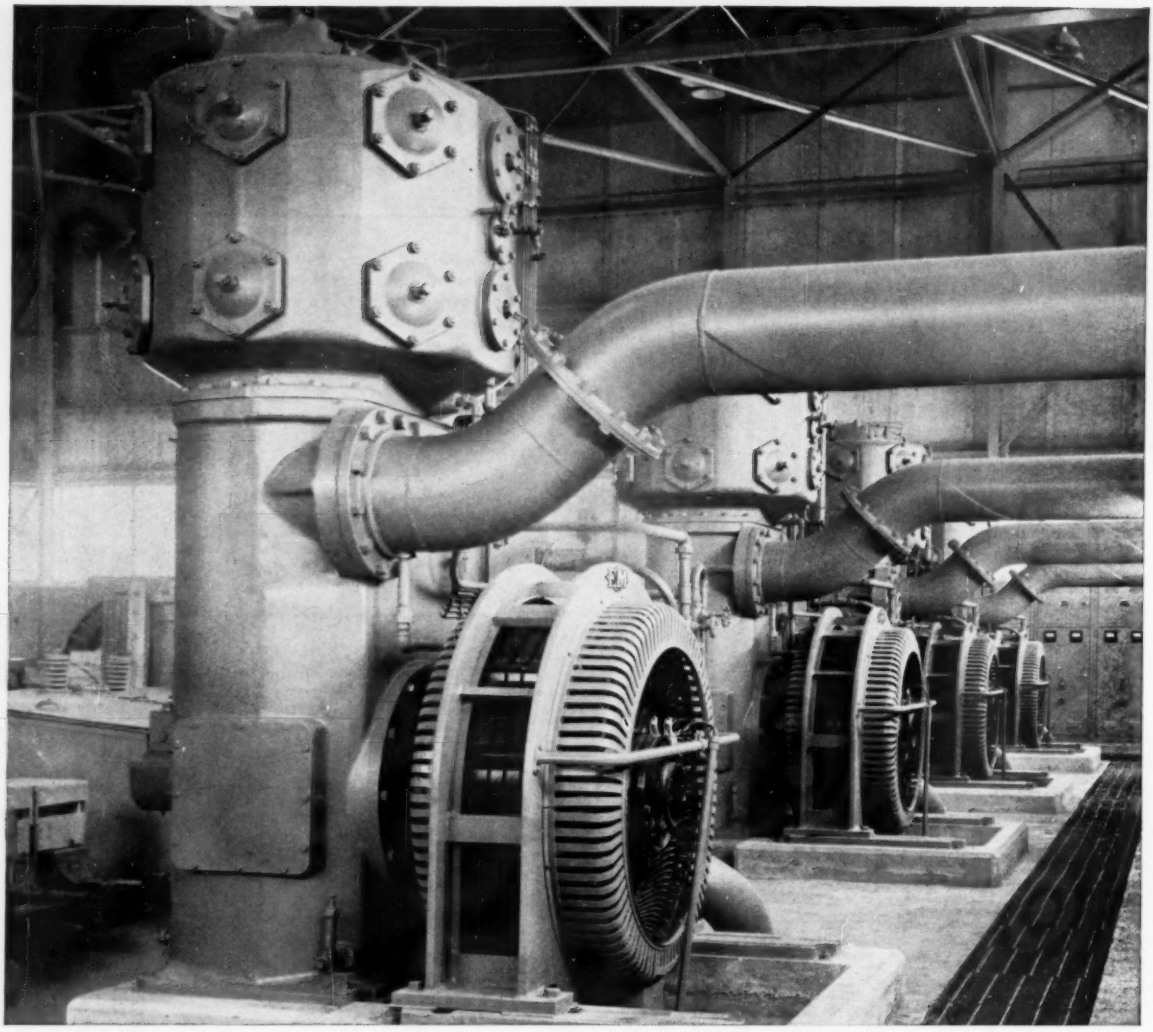

Start---Stop...Start---Stop...Start---Stop

● That's the way it is for these electric motor-driven compressors supplying air for underground mine use at The New Jersey Zinc Company Sterling Mine, Ogdensburg, New Jersey. Four 350 hp, 1.0 power factor, 450 rpm E-M Engine-Type Synchronous Motors, shown above, drive four two-stage air compressors which supply air for tools and other mine operations.

Since the air driven equipment in use at any given time may vary widely, the compressors are called on to operate at any of sixteen steps of loading and unloading, as selected by a specially designed sequence control panel. This means repeated starts and stops day after day, putting unusual stress on the motor windings.

E-M engineers designed these motors for rugged starting duty. The stator coils are wound and lashed with extra strength and the starting cage windings have high capacity to withstand heavy repeated starting stresses.

And here's why these E-M Motors provide a most economical, reliable, trouble-free drive for the compressors:

1. **High Efficiency,** utilizing electric power most sparingly.
2. **Power Factor Correction,** reducing power costs.
3. **Direct Connection,** simplifying installation.
4. **Simple Starting** with "CONSCIOUS" CONTROL, through E-M "Hi-Fuse" Control with Polarized Field-Frequency System.

For specific information on how E-M Synchronous Motors can help you get top performance from large compressors, get in touch with your nearest E-M sales engineer. Write for E-M Synchronizer No. 32 on air compressor drives.

ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA

E-M

1200-TPA-2161

Specialists in making motors do **EXACTLY WHAT YOU WANT THEM TO**

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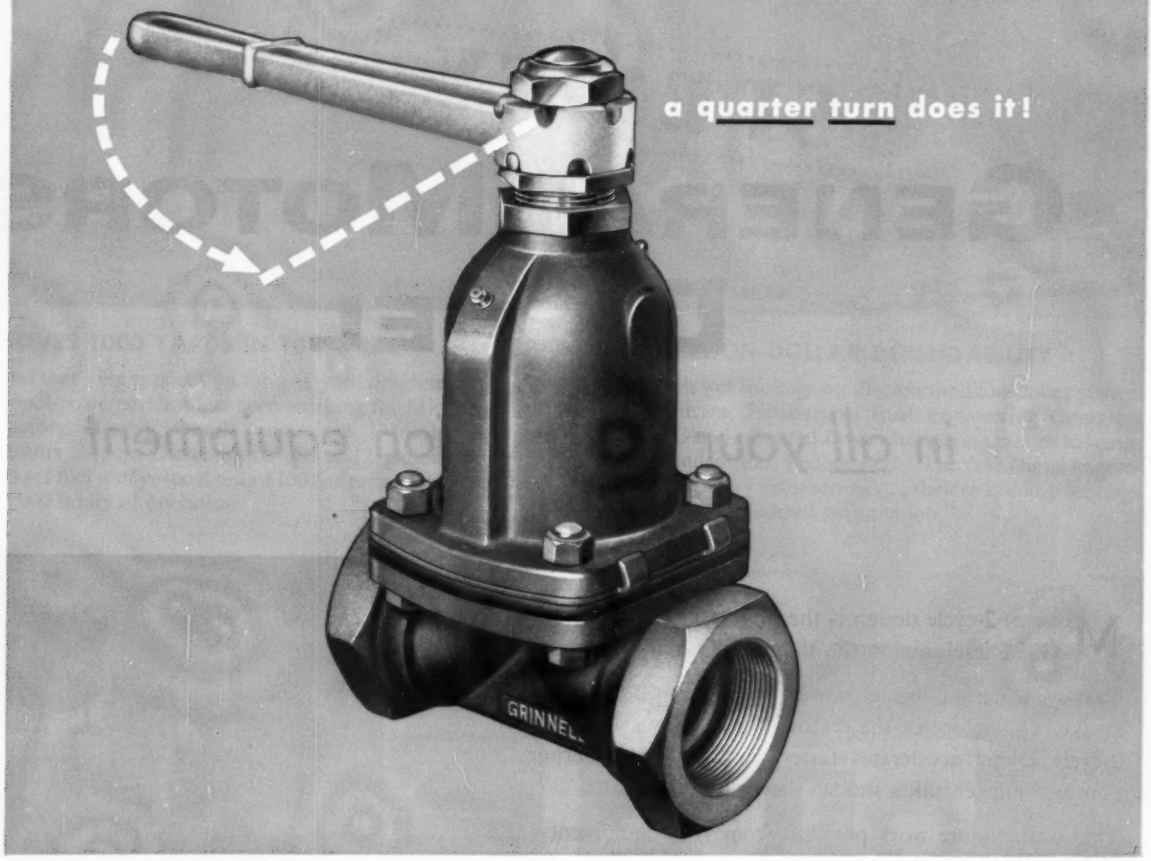
Newest...and Fastest in Compressed Air Control Valves



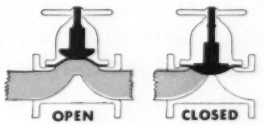
Grinnell-Saunders Diaphragm Valves

Only *one quarter turn* of the control lever is needed to close or open the new QUICK-ACTING Grinnell-Saunders Diaphragm Valve. The lever actuates a shaped cam that lowers or raises the valve stem smoothly and with relatively little effort. Easy operation is secured by careful design of the cam surfaces, to apply increasing force as the resistance to closure increases.

In the smaller sizes, this new valve is ideal for air-operated tools, presses, clamps, molds, or wherever fast control is requisite. In the larger sizes it supplies quick control of air agitators, or large headers at compressors where speed may be a factor in safety.

All of the established and outstanding features of Grinnell-Saunders Diaphragm Valves are retained: complete isolation of all working parts, leak-proof closure, a high lift for full streamline flow, freedom from clogging, a choice of diaphragm materials resistant to oil and to most chemicals, body linings to suit the required service, and easy maintenance.

For further details, write for Grinnell-Saunders Diaphragm Valve catalog.



Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

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For faster job-cycles make it 2-Cycle Power

SPECIFY GENERAL MOTORS DIESEL

in all your construction equipment

MODERN 2-cycle design is the main difference between GM Diesels and most other Diesels built today.

Two-cycle design means power on every piston downstroke. This is one of the reasons why a General Motors 2-cycle Diesel accelerates faster, responds to governor controls quicker, takes sudden shock loads in stride.

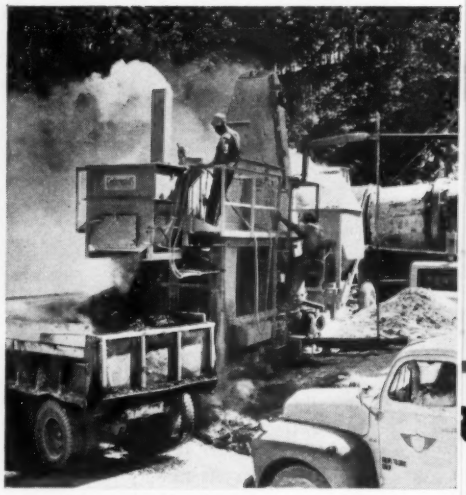
That means more work per shift from your equipment—means you can handle bigger contracts with fewer units, keep your capital investment down and your profits up.

But you get more than faster work when you *specify* GM Diesel power.

You get engines that are easy to service and maintain, that help you keep parts stocks low because of the high degree of parts interchangeability. You get engines that start at the push of a button with no auxiliary, even in wet weather and when it's cold.

And you get Diesel engines backed by a network of GM Diesel distributors ready to supply fast service and quick delivery of low-cost factory parts where and when you need them.

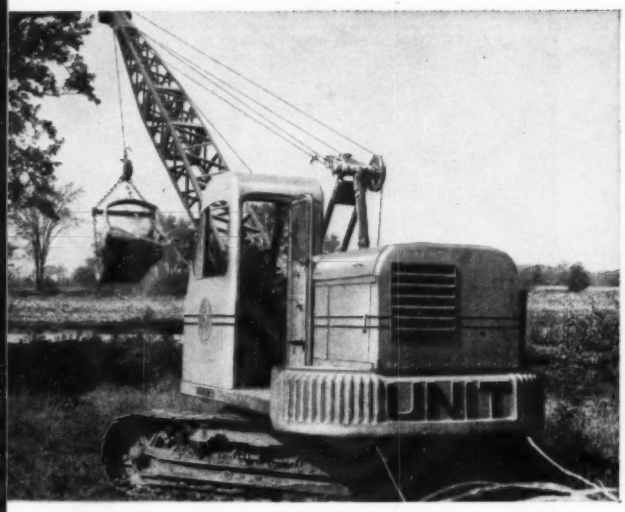
Today you can specify GM Diesel power in over 750 different models of equipment built by more than 150 manufacturers. Get their names from your local GM Diesel distributor or write direct for the list.



"QUICK SERVICE WHEN I NEED IT"

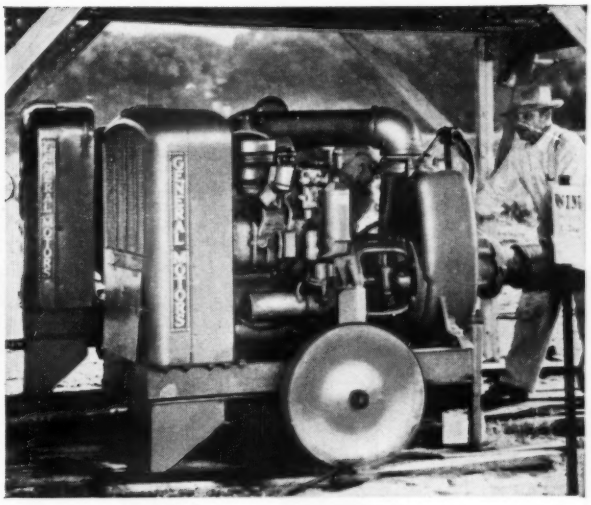
Iowa's Gene McClain Construction Company has GM Diesel power in this Cedarapids asphalt plant and in a shovel. Superintendent Jim Grundy says, "We've standardized on GM Diesel power for this operation because GM Diesels are economical to run. Dealer service is quick and good . . . the company stands behind their product."

GM
GENERAL MOTORS
DIESEL POWER



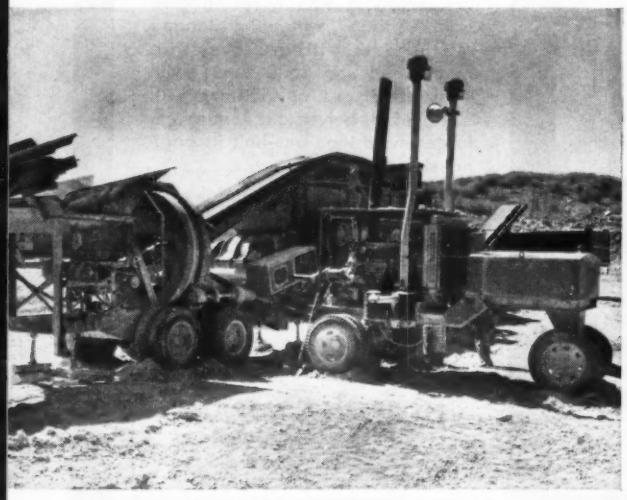
MOVES 1000 YARDS IN 10 HOURS

And that's big production for a ¾-yard dragline. This GM Diesel-powered Unit has been working for Michigan contractors, Henry Schmid Sons, since 1946. Its General Motors 2-cycle Diesel burns about 12 gallons of 14.9¢ Diesel fuel a day—cost only $100 for repairs in more than 17,000 hours of operation.



MULTIMILLION-DOLLAR DEPENDABILITY

Faced with wet footings on this multimillion-dollar sewage plant contract, Pittsburgh's Rust Engineering Company put GM Diesel-powered Jaeger dewatering pumps to work. Superintendent P. J. Pedone says, "The GM Diesel engines have proved very satisfactory . . . they're keeping footings dry so we can go ahead with the job."



3 GM UNITS ALMOST DOUBLE OUTPUT

Kansas' Reno Construction Company reports their new Cedarapids portable rock crusher with three new GM Diesels stepped up output from 200 tons per hr. to almost 400 tons. One "6-110" Diesel powers the primary 36" x 45" double impeller impact breaker; a GM Twin "6-71" powers the secondary and a "3-71" powers the conveyors, screen and feeders.

25% MORE WORK FROM GM DIESEL POWER

One of the best known excavating companies in Northern New Jersey and New York State is Raymond L. Cole Construction Co. "Our GM Diesel-powered American shovels do at least 25% more work than other Diesels in the same number of hours. They are more flexible," reports this user of one 1½- and three ¾-yard shovels . . . all GM powered.

DETROIT DIESEL ENGINE DIVISION

GENERAL MOTORS • DETROIT 28, MICHIGAN

Single Engines . . . 30 to 300 H.P. • Multiple Units . . . Up to 893 H.P.

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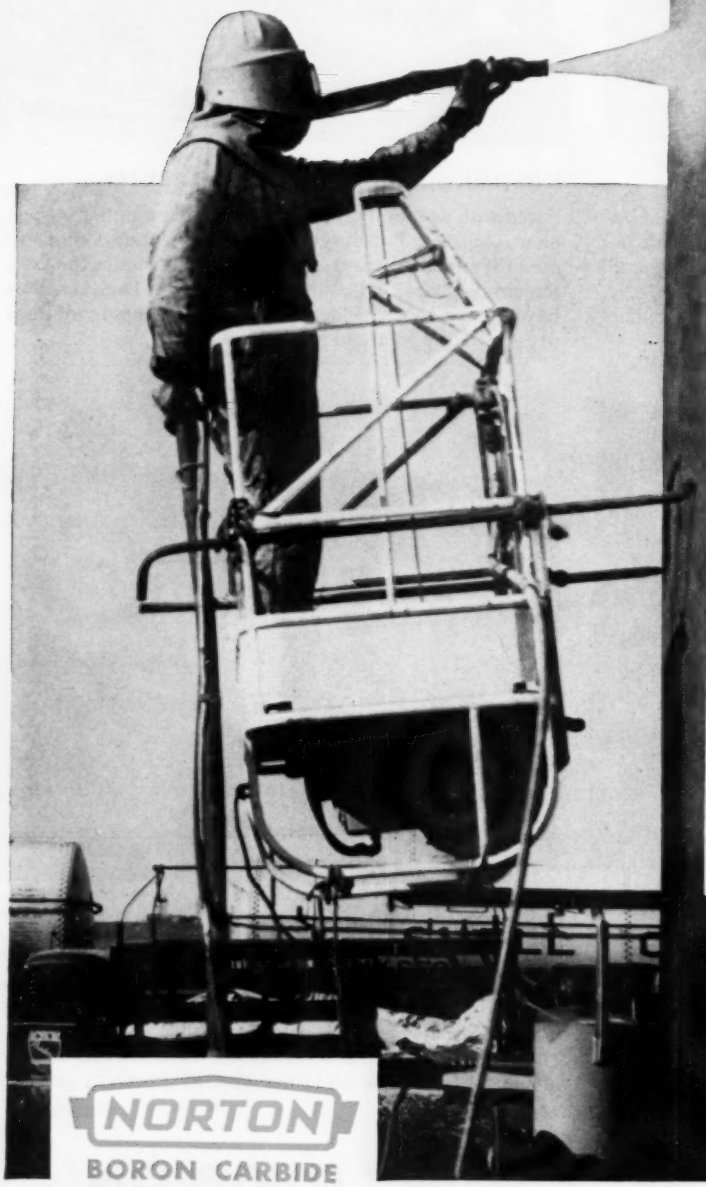

If you are descaling large areas like this storage tank, or cleaning small areas, you'll get maximum blast cleaning efficiency at minimum cost when you use NORBIDE Pressure Blast Nozzles.

These nozzles — lined with the hardest material made by man — are available with bores ranging from ⅛" to ⅜", with either flanged or threaded fittings. They are guaranteed for 1500 hours with steel shot or grit, or 750 hours with silica sand before the outlet enlarges more than one-half its original size.

This amazingly slow rate of wear helps conserve compressed air, reduces cleaning time and provides maximum efficiency from equipment and crew.

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ON THE COVER

THROUGH the courtesy of The Metropolitan Water District of Southern California we are able to show on our cover the clearest picture of giant Hoover Dam that we have ever seen. It was taken by Louis J. Chazaro, senior photographer-blueprinter in the reproduction section of the organization. It shows the powerhouses, downstream dam face, outlet towers in Lake Mead and even the rock formations in remarkable detail. The extent of the shore line showing below the high-water mark in the reservoir reflects the serious water shortage in the upstream basin from which the Colorado River obtains its flow. Water in storage in California areas on February 1 was five million acre-feet lower than a year ago, and most of the shortage was in Lake Mead. Power generation has been reduced because of this condition. This almost nation-wide drought trend is discussed on page 149.

•

CONFUSION OVER CAPITOL

EDITOR:

The picture on the cover of the March 1955 issue interests me but its caption, "Construction of the National Capitol" is surprising because I fail to find any detail in that picture which closely resembles the Capitol. On the other hand, all of the details appear to be identical with the Treasury Building in Washington.

In the article on your contents page you mention the stone dated September 16, 1861, as evidence that the picture was taken when one of the present wings was being added to the Capitol.

Rider's *Washington* states that the new Senate Chamber was first occupied in 1859 and the House Chamber in 1857. This same book also states that the south wing of the Treasury was completed in 1861.

The windows on three floors, the type of columns (monolithic with ionic capitals) and all of the other evidence that I can find indicate that your picture shows the construction of the Treasury Building. Anyway, it is an interesting example of early photography.

EDWARD STEAD
ELKRIDGE, MD.

Mr. Stead may be correct. We are not familiar enough with Washington architecture and history to argue the point. The caption received with the photograph from Wide World Photos, Inc., of New York, identified it as showing a section of the Capitol Building, and that is apparently the way it was described when it was displayed among other early photographs in Chicago in January by the Chicago Historical Society. A query to the photo agency brought no additional information.

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Implement Maker for the World's Farms

The leaping-deer trademark is an emblem of high-grade farming equipment. The 118-year-old firm uses lots of compressed air in its manufacturing operations

STEEL FROM OVERSEAS

The first shipment of steel to Andrus & Deere to arrive from England cost $300 per ton delivered in Grand Detour. This was a huge sum in 1843 dollars, but the metal was cheap measured in terms of land opened and crops made possible by the plows fashioned from it. Three years later John Deere was able to obtain the kind of steel he needed in the United States.

R. J. Nemmers

LAST year about 12 percent of the men, women and children in the United States produced sufficient food not only for themselves and the remainder of the country's inhabitants but also for millions of people abroad. Their feat is even more remarkable when compared with the agricultural output of 150 years ago. Then nearly 75 percent of the population lived and worked on farms, managing to feed themselves and the other 25 percent but exporting only a trickle of their crops.

Even so, the comparison is misleading, because Mr. Modernman's diet is much more varied than that of his forebears. So productive are today's farmers that we can afford the luxury, incredible to less fortunate peoples, of burning up more than 100 calories of grains and grasses to provide only 10 calories of edible meat. And today his chores are less back-breaking and his hours shorter than were those of his predecessor.

The fantastic increase in productivity is attributable to three factors: improvements in basic crops—that is, the development of hybrid and pure-bred strains of plants and animals; improvement of the soil (fertilizers, irrigation, etc.); and, most important, new and better farm machinery. Irrigation and fertilization have been practiced for centuries; a certain amount of research in animal husbandry has been carried on since man first began to record his doings; but up to the early nineteenth century really significant mechanical advances had not gone beyond the wheeled cart, the collar or yoke for draft animals, the scythe and scythe cradle and the water pump. Even today a large part of the earth's surface is being tilled with tools more primitive than these: sharp sticks serve as plows, and some grains are harvested stalk by stalk with little knives wielded by women and children. In the more progressive regions, however, huge machines move across the fields, multiplying one man-hour of work a hundredfold. And many of them are green in color, matching the verdant fields and bearing the leaping-deer trademark of Deere & Company, one of the world's largest manufacturers of farm equipment.

The story of Deere & Company begins in 1836 when an ambitious young blacksmith left his native Vermont and made his way to Grand Detour, Ill., a little town located on the Rock River about 100 miles due west of Chicago. Two days after his arrival the 32-year-old smith was at work in his own shop repairing a broken mill shaft. He was kept busy shoeing draft animals and repairing the crude wood-and-cast iron plows of the day. And he listened to the complaints of pioneer farmers: "No plow will scour in this soil," they said, "and it's too bad, too. It's the richest land in the country."

And rich it was, some of it the most fertile to be found anywhere, but sticky and clinging. Once a crop was put in no plow then available could turn that earth again. John Deere watched family after family stay for a while, try to farm a patch of prairie land, and then pull up stakes and head for the timberland there patiently to grub out a few acres in more friable soil which their plows could work.

John Deere believed in the future of the plains and in the good rich earth. He wanted to move his family west and settle down. He also had an idea; a belief that a plow made of steel and of the proper shape would clean itself. Out of a log he carved a pattern and obtained the only piece of steel available—a

PLOWING — 1837 AND 1955

An oil painting, left, by W.H. Hinton depicts the excitement caused by John Deere's first steel plow in 1837. Proper design produced a plow that would scour—clean itself. The picture below shows a modern 4-bottom Deere plow in service. Besides being faster because of the additional shares, it can be hitched to some 40 or 50 untiring mechanical "horses" and thus easily do as much work in an hour as the first Deere self-polisher could in a day.

broken mill-saw blade. He heated and hand-hammered it into shape, fastened it to a wrought-iron landside and standard and fitted it with handles and a beam of native white oak.

The young smith worked long and hard on his "great idea." It is recorded that a clerk rooming above the Dana & Throop general store across the street chided John Deere for keeping him awake with the constant whang of his hammer far into the night. The steel plow was tried out again and again on nearby farms, each time showing more signs of being what he had in mind. After each trial the husky inventor shouldered it, carried it back to his shop and took it apart to change the shape of the moldboard.

Then one day in 1837 the prototype of the plow that prairie farmers came to know as John Deere's Self-Polisher was tested on the Lewis Crandall farm across

TWO COMBINES

Though they look different both machines collect small grains. Above is a hillside model designed for use in the great rolling fields of the wheat belt. It is self-propelled and levels the superstructure automatically while the mower and pickup attachments follow the lay of the land. It has power steering and power brakes. These innovations reached farm equipment before they did automobiles. The machine at the left is tractor drawn and working in an oat field. It is designed for use on smaller tracts where a self-propelled combine would not be practicable and where leveling apparatus is not needed.

the Rock River from Grand Detour and on a piece of land in which, it was said, no plow would ever scour. Using a borrowed horse, John Deere guided his steel implement through the black loam and left behind a clean-cut furrow and a cleanly broken furrow slice. Although it is not officially recorded, the first orders for his plows were probably taken that very day. His invention a success, the blacksmith sent for his family. Searching the countryside for saw blades, and turning out plows as fast as his forge could work, John Deere became a pioneer manufacturer in the truest sense.

By 1843 Deere had to have additional capital and formed a partnership with Leonard Andrus, the mill owner who had supplied the broken saw blade for the first Self-Polisher. His forge needed a surer source of steel than old blades, however, and after fruitless attempts to find an American supplier he arranged for a shipment of special rolled steel all the way from England. The material came by steamship across the Atlantic, by steamboat up the Mississippi and Illinois rivers and by wagon the 40 miles overland to Grand Detour. It cost $300 a ton, but it proved its worth in service. The arrangement was indicative of the credo established by John Deere when he said, "I will never put my name on an implement that hasn't in it the best that is in me."

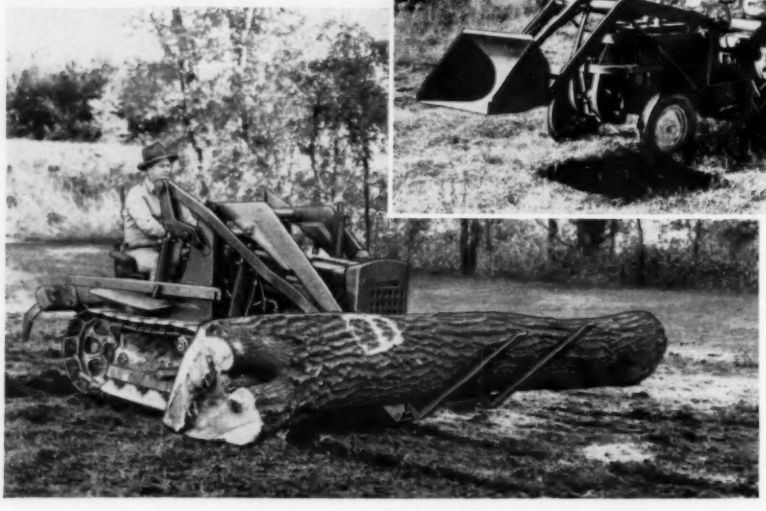
By 1846 sales had reached a point where the growing company was experiencing distribution and supply problems. John Deere, with an eye to the future, sought a new location for his plow factory and selected Moline, Ill. Even then Moline was a bustling little town, and its site on the Mississippi River could be depended upon to furnish cheap water power and transportation. Plentiful coal also was available from nearby mines. Before making the change, Deere journeyed to Pittsburgh, Pa., and induced Jones & Quiggs Steel Works to furnish him the kind of steel he required and had been importing at great cost. The following year the partnership was dissolved and John Deere established his works in Moline where 700 plows were sold the first year.

The business grew rapidly with the influx of settlers. Nearly every family that journeyed westward needed a plow, and those made by Deere were the best to be found. Soon he had designed 50 special types which were shipped to different parts of the country where plowing conditions were especially troublesome. They proved their worth, and Deere gained nationwide recognition despite communication and transportation difficulties. Finally, one day in 1856, the employees of the Deere Plow Works witnessed the ceremonies that opened the first railroad bridge across the Mississippi. Fifteen years later rails stretched from coast to coast, and the country began to grow with a rapidity that astonished the world. Farm implements which had been delivered by ox-drawn wagons and steamboats could now be sent far afield on the Iron Horses.

Just after the Civil War, in 1868, John Deere reorganized and incorporated his business under the name of Deere & Company. He became the first president, and his son Charles also assumed an executive position in the new firm. With added capital, the concern again surged ahead and initiated a system of branch-house distribution that has played a large part in its development and is still in use. The branches bridged the gap between the factory and the farmer and each carried a complete line of plows adapted especially for local soil conditions.

Under John Deere's guidance, the company soon began to make other types of agricultural implements, and by the time of his death in 1886 was well on its way to becoming a manufacturer of a fully integrated line of farming equipment. During the remainder of the century it kept pace with the country's growth—no small task in itself—and built up a sales and service organization unparalleled in the industry. By 1910 the farm population had dropped to 33 percent of the nation's total, and each person engaged in agriculture was feeding himself and two urban dwellers.

In that year the firm merged with six noncompeting manufacturers and 22 sales organizations in the farm equipment field but retained the name of Deere & Company. Practically every one of the concerns added had been first and preëminent in its chosen line, and those plants, plus some others acquired since then, now constitute the House of Deere. There are fourteen factories,

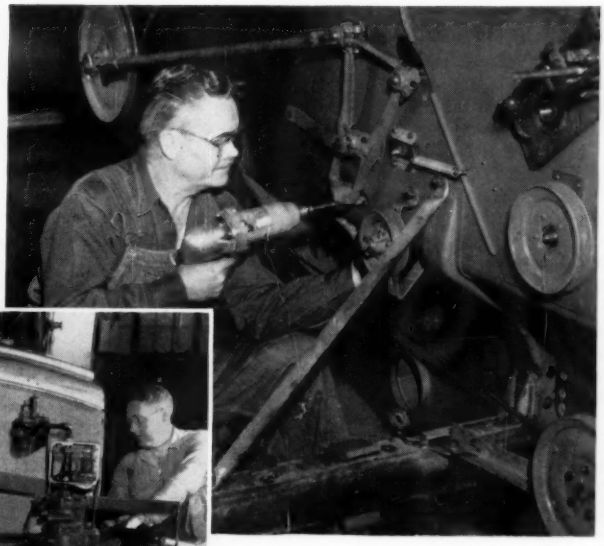


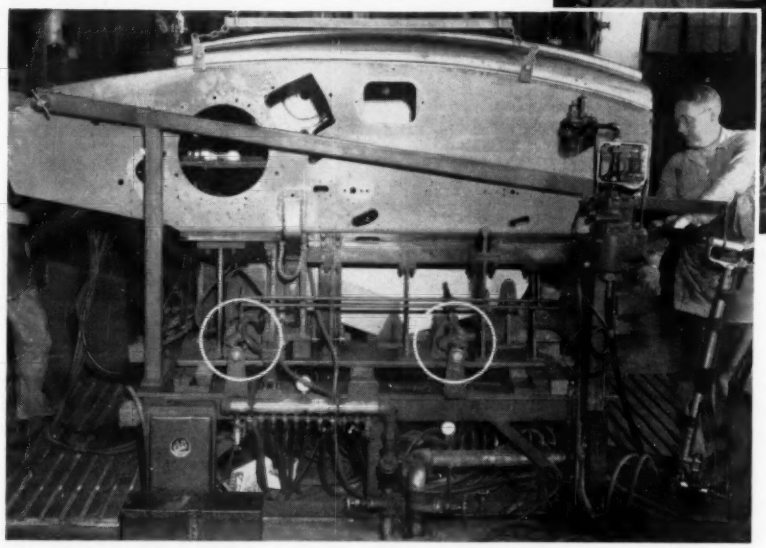
INDUSTRIAL MACHINERY

The Deere 40 Series tractor is mounted on either crawlers or pneumatic tires and may be equipped for varied services in the fields of construction, logging, etc. A fork lift permits the one shown at the left to handle heavy logs. It has a scarifier on the rear. The unit above is provided with a backhoe and is suitable for digging trenches and pits for different purposes.

FACTORY USES OF AIR POWER

In the small area of the combine pictured at the right are visible nearly 40 nuts or cap screws. A complete machine has several hundred of them—more than are found in a modern automobile. To save time and labor in running them, Deere & Company uses air-operated wrenches (more than 600 of them are on Harvester Works assembly lines). The one shown is an Ingersoll-Rand Size 508 Impactool. The job of positioning and holding pieces while they are welded is often made easier by the use of air power. Welders are pictured below spot-welding a combine body whose parts are clamped in a fixture by means of the two air cylinders that are circled in the lower-center. The manifolds and hoses below them carry gas for welding.





nineteen branch houses, an export branch and a synthetic-ammonia and urea plant in the far-flung empire. Separate engineering and research departments serve each one, but central departments coordinate the work and assist the factory groups whenever necessary, thus preventing duplication of effort.

In recent years the company has entered another field—the distribution of sets of miniature John Deere implements—a side line which officials find amusing but of which they are also proud. They were ordered from a toy manufacturer in what started out to be a dealer display "gimmick," but were so popular that Deere was all but swamped with demands for more. It seems that junior farmers wanted toy implements that were just like pop's big ones. And kids and fathers being what they are the distributors had to get into the swing of things and go into the toy business.

Another more serious field in which the firm is now interested is the industrial field, with special emphasis on light construction. In reality, farmers are construction engineers. Cumulatively, they shift around more of the earth's surface in a year than all the big construction spreads put together, and both small and large contractors have found that they can use certain farm machinery to advantage. As one big contractor has said:

"Suppose I've got a couple cubic yards of material to spread around, say, way out on the edge of the spread. I've got three choices. I can send a couple men over to shovel it around. Or I can pull one of my big 'dozers off a job, send it clear over there to make a couple passes at that pile of dirt and then bring it back and put it to work doing the job it's designed for. Both of those are expensive. Instead, I send a man over with a little utility tractor with a small blade on it. Anyone who can drive a car can handle one with a little practice. He's back in a few minutes and I can assign him and the tractor to something else where machine power will save manhours and yet doesn't tie up my big equipment on little jobs." Smaller operators find the equipment well within the range of their pocketbooks and point out that it will do almost everything the big units do.

The nice thing about farm tractors is that they can be made to perform a variety of jobs by means of different attachments to which they can be easily coupled by hitch systems that have been developed through the years. Hydraulic power units are available for all John Deere prime movers, and this energy is used freely not only to assist in operating such attachments but, in some cases, also to help fasten them to the tractors. Deere & Company engineers have been able to adapt many of its implements such as blades and scoops, fork lifts, mowers, etc., for industrial applications, and besides have tested and cleared for use with its tractors a large variety of other muscle-saving devices. (Clearance of equipment means that the company will protect the tractor warranty or guaranty.)

Called the Allied Equipment line, these devices may be purchased through most of the 5000 John Deere dealers and through special "industrial" distributors in the United States, Canada and other countries. Loaders, winches, log carts, backhoes, wheel-type scrapers, portable power saws, post drivers, hole diggers, cement mixers, gang mowers, cranes, dozers, blades, rakes, snow blowers, sprayers, sweepers, trenchers and even fire-line plows are available. Most of them can be utilized with either the regular rubber-tired or crawler-type tractor and many are driven by the tractor's power take-off.

Of the various models obtainable, the John Deere 40 Series tractors are usually used. The 40 Crawler, for example, has a maximum belt horsepower of 24.99 (20.14 drawbar hp) and a top speed of 5¼ miles per hour. There are four speeds forward and one reverse; provision for two power take-offs, regular (560 rpm) and high speed (1850 rpm); and a choice of four or five roller tracks and a wide variety of shoes. The 40 Utility (wheel-type tractor) shows promise of wide application in many industrial fields.

Another diversification effort on the part of the company is the manufacture of urea and ammonia. In a new plant near Pryor, Okla., these vital ingredients of commercial fertilizers are being made synthetically with the aid of large air

and gas compressors. Called the Grand River Chemical Division of Deere & Company, it went into limited operation in the closing months of 1954 and is expected to reach full capacity sometime this year.

The farm-equipment field, however, is still Deere's mainstay because nearly all of its activities are concerned in one way or another with the making of agricultural tools. More than 50 different kinds are listed in the 1955 implement catalogue, and if all the varied sizes, styles and modifications were included the actual number would run literally into the thousands. Of plows alone there are hundreds of types and models, each designed for a particular soil and a given method of farming.

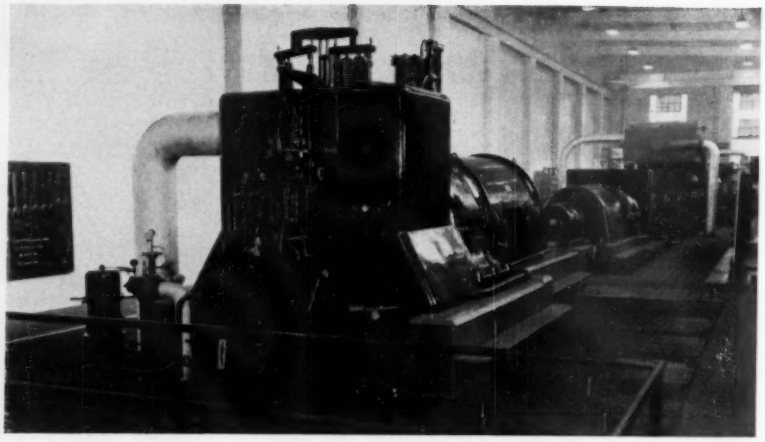
It would be a herculean task to describe in detail all the steps involved in manufacturing the company's full line. However, it is possible to give an overall picture of a single factory—the Harvester Works, for example, which is one of Deere's three East Moline plants. As the name implies, it is engaged in the design and production of equipment for the harvest. The machines are known as combines, windrowers and mowers, and for the benefit of "city folk" we will tell briefly just how they aid the farmer and how they work.

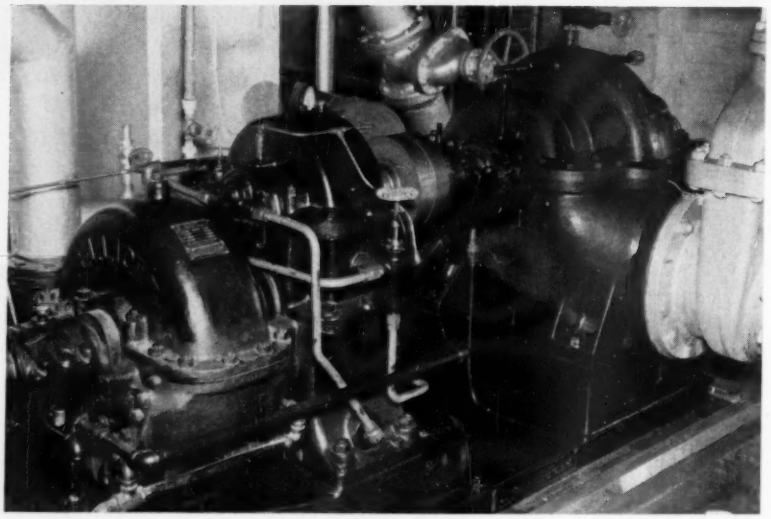
The mower replaces the scythe of days gone and is composed of a set of reciprocating blades or sickles which slip beneath a corresponding set of guard plates in much the same way as a barber's clipper operates. Grass or grain is guided between the guards and is clipped neatly just above the ground by the reciprocating cutter bar which is driven through the tractor's power take-off and is "hinged" or flexibly mounted, thus allowing the mower closely to follow the lay of the land. The mower can be mounted either in front of or behind the traction wheels, but in either case is offset far enough so that the tractor does not pass over the crop before it is cut. One farmer with a modern machine can mow from 25 to 35 acres per day, or about seven to ten times as much as his predecessor wielding a scythe.

In an attempt to get more done in one pass through a field agricultural engineers began to design equipment capable of doing two operations at once and soon came up with a combination machine or combine-harvester. The combine does the multiple job of cutting, threshing and cleaning the crop such as wheat, oats, beans, etc., in a single trip over the ground. A sickle bar, similar to that in the mower and controlled as to cutting height by the operator, cuts the grain just below the "heads" to fall on a feeder platform. A revolving reel helps to lay the grain on the feeder canvas, which carries it into the machine where it is threshed and cleaned of chaff and elevated to an overhead grain tank or, in some cases, to a sacking attachment. The straw is discharged at the rear in a windrow, or, if a spreader is employed, is spread in an even layer throughout the area harvested. A chopping attachment, available for many combines, will further reduce the straw so that it can be readily plowed under to decompose and thereby restore humus to the soil. Thus the combine does in one pass tasks that formerly required from three to five trips through a field.

Whether or not all these jobs can be performed in a given situation depends on the condition of the crop. Where there is a heavy growth of lush weeds, or where the grain itself may need further maturing before it is threshed, the combine is preceded by the windrower. The latter might be termed a wide-cutting mower which cuts the crop and lays it in a neat, compact windrow on dry stubble so that the movement of air can complete ripening of the grain and at the same time reduce the moisture content of the weeds. When the crop has matured, the combine, now equipped with a pickup attachment in place of the cutter bar, picks up the windrow and proceeds with the threshing and cleaning operations and disposal of the straw, as mentioned previously.

All this serves in part to illustrate the complexity of the farm-equipment industry. Today, the many different methods of farming, kinds of soil and crops and sizes of fields call for machines varying widely in type and design. One interest-





OL' MAN RIVER HELPS

Mississippi River water is diverted through Harvester Works' powerhouse to condense steam, cool compressors, etc. An Ingersoll-Rand centrifugal pump (lower picture) circulates 2930 gpm of water through an I-R heart-shaped surface condenser that pulls a vacuum on a General Electric turbogenerator. An Elliott 46-hp steam turbine drives the pump at 1200 rpm through a 4-to-1 reducing gear. The top view shows the generating room. The unit in the background has a record of trouble-free service since it was installed in 1940. It operates at 175 psig steam pressure with 100° superheat.

ing variation of the basic combine is the model built for hillsides in which the cutting unit or platform follows the lay of the land while the threshing and cleaning unit is leveled automatically for most efficient functioning and optimum stability on steep grades.

John Deere Harvester Works was started in 1912 when the company was already 75 years old. Its broad knowledge of farm problems and its successful distribution and sales force were applied to the task of putting John Deere grain binders and other harvesting equipment into an influential position in what was even then a highly competitive market. That the goal was achieved is evidenced by the scope of its present operations. An interesting commentary on the ever-changing picture of American agriculture is that the production of the grain binder, for which John Deere Harvester Works was established, has been supplanted by the manufacture of the crop-saving combine.

The plant now occupies a 225-acre tract bounded on one side by the Mississippi River and on another by the John Deere Spreader Works. There are 2,544,875 square feet of floor space under roof, and the whistle normally calls to work about 2600 employees. Actual production varies with the orders to be filled and the expected demand, but if an average year's total output were put on one train the engine would be on the opposite shore of the Mississippi River and approximately 50 miles inside the State of Iowa before the last car was even loaded.

Although the malleable castings used come from the John Deere Malleable Iron Works just a few blocks away, Harvester Works' own foundry pours some 12,000 tons of gray-iron castings annually. In addition, the plant processes around 48,000 tons of steel in a year. Helping out in the big undertaking of converting so much raw material into mowers and harvesting equipment is a compressor plant with an installed capacity of 8456 cfm divided among five units. These machines compressed 738,917,000 cubic feet of free air and delivered it at a pressure of 100 psi during the 1954 fiscal year. Not all this air was consumed in the Harvested Works, however; about one-third of it was piped to the Spreader Works "next door."

The compressors are driven by steam, which is supplied at the plant and also used to produce electricity. Two steam turbogenerators handle the basic electric load, and one of them has set a remarkable record for trouble-free service. Installed in 1940, it has run at full capacity 40 hours a week since then without a breakdown and has frequently put in extra time at reduced loads.

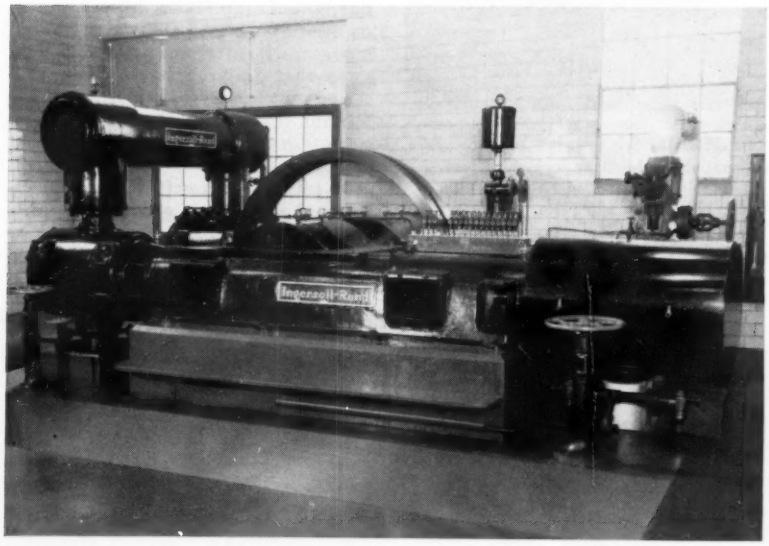
A General Electric noncondensing unit, it operates at 175 psig steam pressure with 100° superheat and discharges into an Ingersoll-Rand heart-shaped condenser. Cooling water for the latter is drawn directly from the Mississippi River and circulated by a single-stage 2930-gpm pump of the same make. Condensate from the hot well is returned to the boilers by a 3-stage, 415-gpm I-R feed pump. Make-up water for the boilers is also obtained from the Mississippi and treated in softening tanks which reduce hardening agents to about six parts per million.

Compressed air does a multitude of jobs in the production cycle at Harvester Works. It serves to power hoists, cylinders for clamping and holding parts and materials and for advancing and retracting tools and workpieces, to operate chucks and to clean machines and parts by the aid of blowguns. Along the assembly lines are more than 600 pneumatic impact wrenches, and there are numerous grinders, chippers and vibrators in use in the foundry. Paint-spray guns likewise consume large quantities of compressed air. And because most farm equipment now runs on pneumatic tires, a considerable amount of air is required for tire inflation. Several of the more interesting air applications are described in connection with accompanying illustrations.

Although "looks" do enter into the purchase of farm equipment, in the last analysis it is performance that counts. The products that roll from the Harvester Works' assembly lines might, at first glance, seem to be ungainly, but closer examination will reveal that there is a good reason for each of the hundreds of parts that go to make up, say, a combine. Some of them are safety devices and shields, because farmers are just as prone to injury by heavy machinery as are their cousins in the nation's mills and factories. It is a credit to the industry as a whole that modern farm equipment is so free from possible danger spots and that mechanical failure is rarely ever to blame for the accidents that do take place.

The long-range future of American agriculturists, and, consequently, of farm-equipment makers seems bright. Experts say this is so because we have long ago reached the point where little or no new land is being opened to cultivation. For every acre gained by vast new irrigation projects we are almost sure to lose one to the expanding suburban areas. Our population is growing by leaps and bounds. Statistics show that nearly 11,000 babies were born each day in 1954, enough to people a city of the size of Akron, Ohio, every month. And as every parent knows, the youngsters have hearty appetites.

Our population is multiplying so fast in fact that the nation's farmers will, by 1970, have to feed 200 million people from about the same acreage they are now cultivating to feed 160 million. To do this and at the same time export vast quantities of food in the hope of maintaining a free world, more and more labor-saving devices will be needed to boost productivity. It is certain that many of them will be green or yellow and carry the leaping-deer symbol of Deere & Company.



A SOURCE OF AIR POWER

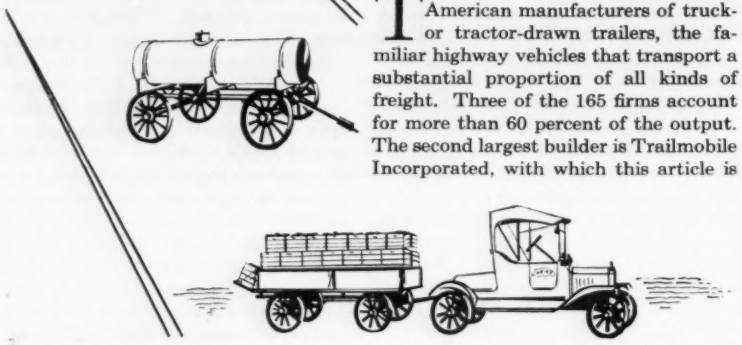
The plant has five compressors that have a combined capacity of 8456 cfm and compressed 739 million cubic feet of free air in the last fiscal year. Part of this was sent to the Spreader Works "next door." The machine shown is one of two duplicate Ingersoll-Rand units each having a capacity of 2200 cfm. Another I-R machine of 1156 cfm installed in 1916 is still in operation.

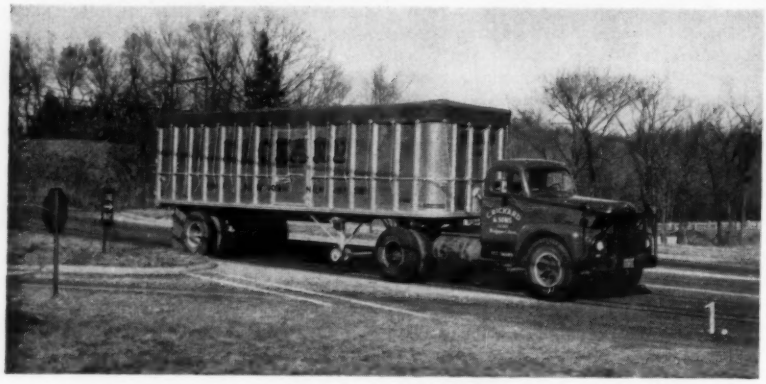
TRAILERS TO ORDER

Trailmobile's New CID Merchandising Plan Lets Each Purchaser "Roll His Own"

C. H. VIVIAN

THERE are approximately 165 American manufacturers of truck- or tractor-drawn trailers, the familiar highway vehicles that transport a substantial proportion of all kinds of freight. Three of the 165 firms account for more than 60 percent of the output. The second largest builder is Trailmobile Incorporated, with which this article is mainly concerned. It turns out roughly one of every five trailers made and produces just about every type. Its headquarters and main factory are in Cincinnati, Ohio, and it has two other plants in this country and one in Canada, with around 3500 employees all told. Its sales outlets blanket the United States, and it markets trailers abroad through its export department and representatives in various countries.





THEY'RE ALL TRAILMOBILES

A few of the many different models that are available. 1– Open-top, aluminum-body van with outside reinforcing posts. 2– Drop-frame furniture van with high interior headroom and central side door. 3– Refrigerated and insulated body with horizontally corrugated aluminum sides and tandem-truck wheels. 4– Gasoline carrier. 5– Flat-bed, tandem-truck body for hauling heavy loads. Models with lower beds range up to 50 tons carrying capacity.

Trailers exemplify the principle that a load can be drawn more easily than it can be carried. Through the centuries, the principle was put into practice wherever a cart or other type of conveyance was hitched behind another one. Common current examples aside from highway trailers are railroad trains and also barges towed by a boat. The idea behind truck or tractor trailers is not new, then, but its modern application was given great impetus by harnessing the internal-combustion engine to transport vehicles.

Even though the now familiar motorized trailer has been in use less than 50 years, rival builders don't agree on who originated it. Their own trade organization, the Truck-Trailer Manufacturers Association, Inc., doesn't go on record in the matter. Our own research indicates that trailer transport was conceived prematurely by our British cousins, and it remained for American concerns to reintroduce it later and make it workable.

In 1898, Thornycrofts in England announced a 6-wheeled, articulated vehicle consisting of a short 4-wheeled truck on which the forward end of a long 2-

wheeled trailer was superimposed. The idea was ahead of its time and lay dormant in Great Britain for twenty years. On this side of the Atlantic, however, it was revived sooner. Responsible for it, according to Trailmobile's records, was its predecessor concern, the Cincinnati carriage builder Sechler & Company. That firm was established in 1877 by D.M. Sechler who had previously learned the trade in a shop in Milton, Pa., where he had apprenticed himself in 1835. When he opened up in Cincinnati that city was the center of the nation's thriving carriage industry, and the Sechler plant became the largest of its kind.

John C. Endebrock, a Sechler representative in Europe and other foreign areas, is credited with having projected the concern into the trailer business. Upon returning to this country from a trip to South Africa in 1910 he convinced his employer that automobiles were here to stay and would eventually replace horses. At his suggestion Sechler began the manufacture of a light vehicle that could be pulled by a Model T Ford. It had a carrying capacity of 1000 pounds. A Brooklyn firm was already making a 2-wheeled trailer, but the services of two men with jacks were required to couple it to its tow car. Endebrock improved upon that method by inventing and patenting the now familiar fifth-wheel hookup, which is still the standard connecting medium. From the outset the Sechler vehicle was called Trailmobile, and in 1944 the concern changed its name to The Trailmobile Company.

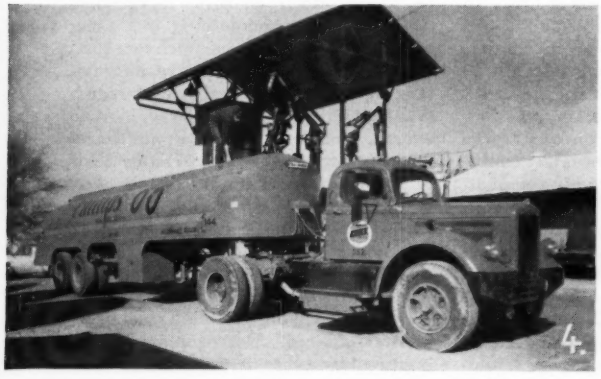
Regardless of who originated the modern trailer, it is certain that it was incubated by the carriage and wagonmakers of the preautomobile age. The earliest automotive types were, in fact, simple 2-wheeled carts or 4-wheeled wagons built almost entirely of wood and rolling on iron- or steel-tired, wood-spoked wheels. They had no brakes, no lights and no doors. They were not constructed to withstand the jolting to which they were subjected on the miserable roads of their day and were soon shaken to pieces.

A marked transformation from wagon to automobile types began about 1919-20. Manufacturers were then learning how to build sturdier bodies, to couple truck and trailer together more securely (*a la* fifth wheel) and to eliminate the need of jacking up the noses of semi-trailers to back trucks with couplings under them. Crude lever-actuated brakes, which the driver in his cab applied by pulling on a rope, appeared in 1917. By that time hard-rubber tires were in use, a tank trailer had been produced and engineers were experimenting with refrigerated bodies for hauling bottled milk. Shuttle service, in which a truck pulls one trailer to its destination and there picks up another one that has meanwhile been loaded, had been established as one of the chief advantages of trailer transport. How this actually works out in practice is indicated by the fact that there are about 170 trailers for every 100 tractors in use (1952 figures).

Trailer building began to assume importance around 1925, but authentic statistics on the number of units made or in service were lacking until around 1939 when the still small but potentially gigantic industry gained fresh impetus as preparations for national defense placed added emphasis on trailers as mediums for transporting food, munitions, supplies and even men. In recent years trailer output has fluctuated considerably in tune with the changing demands of the Armed Forces and other government agencies. In 1945, for instance, production totaled only 33,266 units, but pent-up civilian requirements boosted it to 76,234 in 1946. Then the trend was downward for three years, but shipments

SHIFTING AXLE POSITION ON THE ROAD

By removing a steel rod, as the driver is doing here, the tandem-axle truck on van trailers can be moved forward or backward in increments of 3 inches for a total distance of 45 inches, thereby shifting the weight of the cargo without removing it. Bronze blocks, fastened to the lower subframe of the tandem suspension, slide on a stainless-steel track along the base of two stationary steel beams. The wheels, tires and axles of a tandem-axle trailer weigh more than the completely insulated and lined body. A fully insulated van trailer body, with a floor strong enough to withstand the heaviest power loading, weighs approximately 100 pounds per foot.



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CID "SHOPPING AID" FOR TRAILER BUYERS

This is a reproduction of one side of a printed form used by salesmen to show prospective customers some of the many different forms of components from which they may choose in ordering a Trailmobile designed expressly to meet their individual operating conditions. This "Customer Individualized Design" plan has markedly spurred sales.

rebounded to 65,665 trailers in 1950. Output and its value since that time have been as follows:

YEAR	UNITS	VALUE
1951	67,384	$245,315,000
1952	58,077	228,366,000
1953	97,689	294,849,000
1954	55,000	———

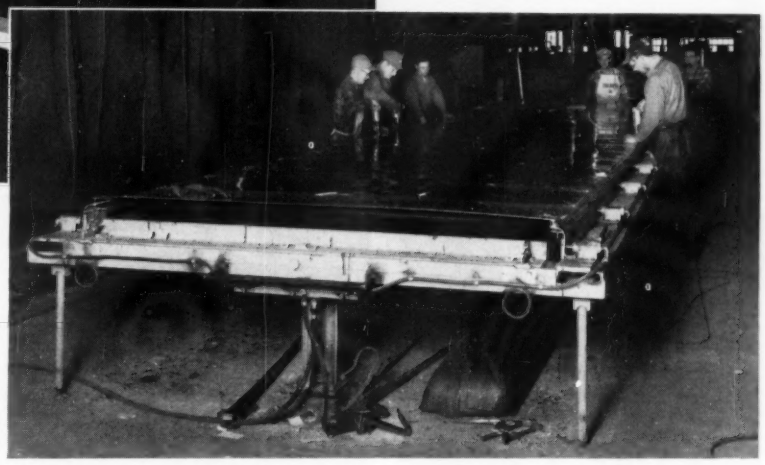
The outlook for 1955 is considered so bright that manufacturers are predicting that they will exceed the 100,000 mark for the first time. Van-type bodies normally represent about 50 percent of the total, followed by platform or flat beds, around 20 percent, and tank types approximately 12 percent. Pole and logging models, which have dropped from a one-time 10 percent to below five, and low-bed, dump and other miscellaneous types make up the remainder.

According to American Trucking Associations, Inc., the number of trailers and semitrailers of 5 tons capacity or bigger in use has increased as follows: December 31, 1941– 169,233; August 31, 1944– 218,269; 1951– 405,000: 1954– 535,000 (estimated). A side light on truck-trailers is that they represent less than one percent of the vehicles on the highways but pay 12 percent of the taxes ($362,170,000 in 1952, the latest year reported).

America leads the world in the production of truck-trailers, but other countries are building more and more of them. The blue ribbon for the one with the largest capacity yet to take to the road goes to the British firm of Cranes Ltd. In 1953 that concern constructed a low-bed unit that can carry loads up to 200 tons in weight and 30 feet long. It has an over-all length of 80 feet and its width can be increased, in stages, up to 14 feet. The vehicle is mounted on two trucks each having three axles and twelve wheels with 16x20-inch, 24-ply pneumatic tires.

Although trailer transportation is firmly established, the equipment itself is still far from being standardized. Each of the 48 states has its own idea as to permissible size, and only the maximum width—96 inches—is uniform. Except in California, which has higher limitations, the legal height commonly ranges up to 12½ feet and the length to 35 feet. There is great diversity of opinion as regards allowable loads and how they shall be distributed over the axles. As a result, a certain amount of flexibility is often built into the equipment. Compartmented trailers for hauling bulk materials such as cement, sand and some grains are, for instance, made so that the load can be shifted at state lines, if need be, to conform to changing regulations.

The use of aluminum is increasing chiefly because it weighs much less than steel. One source of industry information reports that each 1-pound reduction in the weight of a trailer will, on an average, enable it to earn an additional dollar of profit every year. Some fields of service, may, of course, call for steel with its greater strength. Numerous variations in body-skin construction also are available to meet different conditions. Supporting parts of side and end panels may be located outside or in, depending largely on whether a smooth interior is desired. Corrugated sides are preferred by some customers (The Amer-



FABRICATING ROOFS

The fixture pictured below has twelve small air-cylinder clamps made by Trailmobile mechanics. They are arranged along each side to hold the side pieces in proper position while the metal skin is being fastened to them with screws. On the other roof fixture a Size 534 Impactool is being used to stretch the metal sheet over the cross members. By turning a screw it exerts a pull on two "C" clamps that are fastened to the sheet.

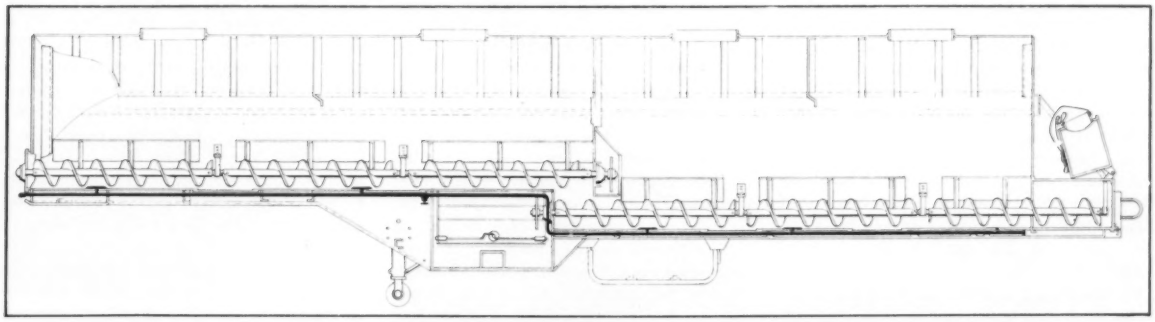
ican Railway Express Company likes them on its city delivery trucks) and the corrugations may run horizontally or vertically.

Getting back now to Trailmobile, the manufacturer merged with the Lapeer Trailer Company, a leading competitor, in 1928 and four years later acquired the Highland Body Manufacturing Company. To supplement the facilities at Cincinnati, a second modern factory that produces all types of trailers was opened in Berkeley, Calif., in 1942, and a plant where tank trailers are built exclusively was established at Springfield, Mo., in 1947. The Canadian factory at Toronto was put in operation in 1949.

In 1951 substantially all the assets of The Trailmobile Company were bought by Trailmobile Incorporated, a wholly owned subsidiary of Pullman Incorporated, for $41,500,000. This purchase was a move by Pullman to diversify its interests which had been curtailed in 1947 when, in compliance with a court order, it had sold The Pullman Company, which owned and operated railroad cars, to a group of railroads. The other phase of its business—manufacturing railroad freight and passenger cars of all kinds—was retained, and in 1944 the corporation acquired ownership of The M. W. Kellogg Company, a leading designer and builder of petroleum-refining equipment and processes.

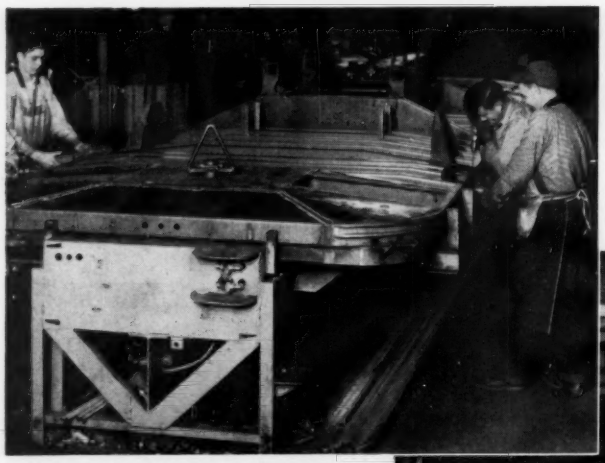
Trailmobile "covers the waterfront" when it comes to trailer design. It makes the three principal types—van, tank and flat bed—in a broad range of sizes and models to satisfy the trade, and the number of possible variations is almost limitless. Vans differ in dimensions, design and materials. A furniture carrier, for instance, will have a stepped-down or drop bed in the center to facilitate loading and to give it maximum headroom for tall pieces. Inside there will be recessed rings for securing ropes as well as overhead racks for stowing rugs and carpets. Such vehicles often have two doors on one side and one on the other in addition to rear doors.

Tank-body trailers are built for hauling liquids ranging from milk to acids



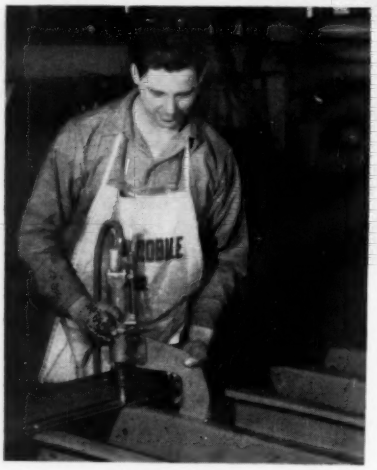
TRAILER BODY FOR HAULING BULK COMMODITIES

Although designed primarily for carrying cement, this body will handle any dry material that flows, such as core sand and certain grains. The cargo is unloaded by means of dual screw conveyors, one serving the front half and the other the rear half. The screws are 9 inches in diameter and can discharge 115 barrels of cement in approximately fifteen minutes. Both conveyors are driven by the same centrally located 8½-hp gasoline engine. The rear screw, which is higher than the other one, is operated first and moves its portion of the load to the central discharge hopper. Then the front screw forces the load in that end back to the same outlet. To assist in unloading cement or any other close-packing material, an air pipe (indicated by the heavy line) with five outlets to aerator pads runs along the bottom. The air, supplied by either the tractor's braking compressor or an outside source, passes through nonclogging fabric diffusors to break up and lighten the material and thus reduce the load on the engine when it starts up a conveyor.



MAKING UP UNDERFRAME

Frames are made up on fixtures that may be adjusted to handle different lengths. Most of the operations are performed with the frame upside down (left), and it is then turned over to complete the work (below). Cross members, called bolsters, are spaced 12 inches apart and fastened to the side members by means of Ingersoll-Rand Airbuck riveters which eliminate the need for a "bucker-up." Twelve of these tools are in service. A close view of one of them is shown at the lower-left. Five soft-iron 5/16-inch rivets are driven at each end of every bolster.



and from gasoline to asphalt. They vary in size, interior finish and loading and unloading equipment to meet their particular fields of service. Some must be well insulated. Even flat-bed trailers, the type without sides commonly employed to transport steel and other metals, solid building materials and machinery, may differ greatly. Some may have up to three 15-inch I-beams under them longitudinally to support the frame. Flooring may be of wood—oak is still the most popular material—or of steel or aluminum. In certain cases the shop builds only a chassis to order and delivers it, say, to a maker of construction equipment who mounts his own product on it as desired.

Considering the almost countless combinations that are possible, it is obvious that no manufacturer can construct standard models that will precisely meet the widely varying needs of customers and at the same time satisfy their individual ideas as to what they would like to have. Trailmobile has, however, come up with a plan by which van trailers are literally made to order. It enables the prospective purchaser to specify exactly what he wants and get it as easily as he would a custom-made suit of clothes from his tailor. Moreover, this special service doesn't boost the price or delay delivery. In fact, the factory can assemble a CID trailer in as little as one week. With a normal backlog, delivery is usually made in five weeks, but currently there is a backlog of eight weeks.

This new idea in merchandising trailers is called Customer Individualized Design, or CID, and is simple in its conception. Basically, Trailmobile merely makes up ample stocks of the various types of components that may enter into a trailer and then draws upon them to put together complete units to meet customers' individual preferences. To illustrate, a buyer may choose from among five running-gear assemblies. He can have either a single- or double-axle type or, if a tandem-axle truck is best for his purpose he can have it in any one of four designs. He can get one with 4-foot spacing between the two sets of wheels or, if he is going to use the trailer in a state where this load concentration is not allowable, he can have either 6- or 9-foot spacing. Furthermore, through a new Trailmobile development, he can obtain a shiftable tandem truck; that is, one that the driver can move backward or forward as desired in a matter of minutes so that the load carried can be distributed properly between the tractor drive axle and the two trailer axles.

In a similar manner the purchaser may select the frame, side panels, doors, floor, roof and other components that he wants or requires. He can have a body with square or rounded corners to meet the needs of the cargo handled. He can have the kingpin (which extends downward from the trailer's fifth-wheel plate to engage and lock into the fifth wheel of the haulage tractor) set at any point within a space of 30 inches in 2-inch increments in order to distribute weight as desired and provide proper clearance for the tractor.

To assist a buyer in making his choices, Trailmobile's advertising department prepared a folder that opens up to a 24x31-inch sheet. On one side of it, in the center, is an illustration of a complete trailer surrounded by pictures of the various types of available components arranged in groups and with arrows extending to their respective positions in the finished unit. With this in front of him, a purchaser can assemble the parts for his trailer easier than a housewife can shop for the ingredients of a beef stew in a supermarket.

There is a bit of sales psychology in the idea and in the nomenclature selected to designate it. The words "customer individualized design" carry the connotation that the buyer assumes the role of designer, and this is, in a sense, true. Although he cannot make changes in the basic components, he does have the privilege of combining those that are obtainable according to his wishes.

The motor-car industry has given purchasers some latitude in the matter of

choice for twenty years, but CID is different. When you buy a passenger car, you can have your pick of only those models that the manufacturer has decided to build and of whatever "extra" equipment is available. However, you can't tell him in advance what you want and have him make it to order. Under CID you can do precisely that. Someone has figured out that it offers 192,000 possible combinations of integral parts, not counting a choice of materials.

The CID plan was conceived by William Burns, Trailmobile president, and a team of the firm's engineers. Burns calls it "the first concept change in the truck-trailer industry since we took the front wheels off wagons." When the idea was born in 1952 the company's pricebook had five sections, each for a standard line or model. Most truckers wanted some changes to meet their particular needs, but they couldn't always get just what they desired. At one time, for instance, if an all-steel trailer was too heavy for a given operation, the customer had to take an all-aluminum one and pay accordingly. Now he can get and pay for only as much aluminum construction as he specifies.

The day after the birth of his brainchild, Burns confided in James J. Black who had been a Trailmobile vice-president for 25 years. Black defined the concept and made up a series of drawings that gained Pullman's approval of what was designated as Project X. Five engineers were then assigned the task of digging into all the technical angles, but no one else in the factory was told what was afoot. Periodically Burns and Black reported progress to Champ Carry, president of Pullman in Chicago.

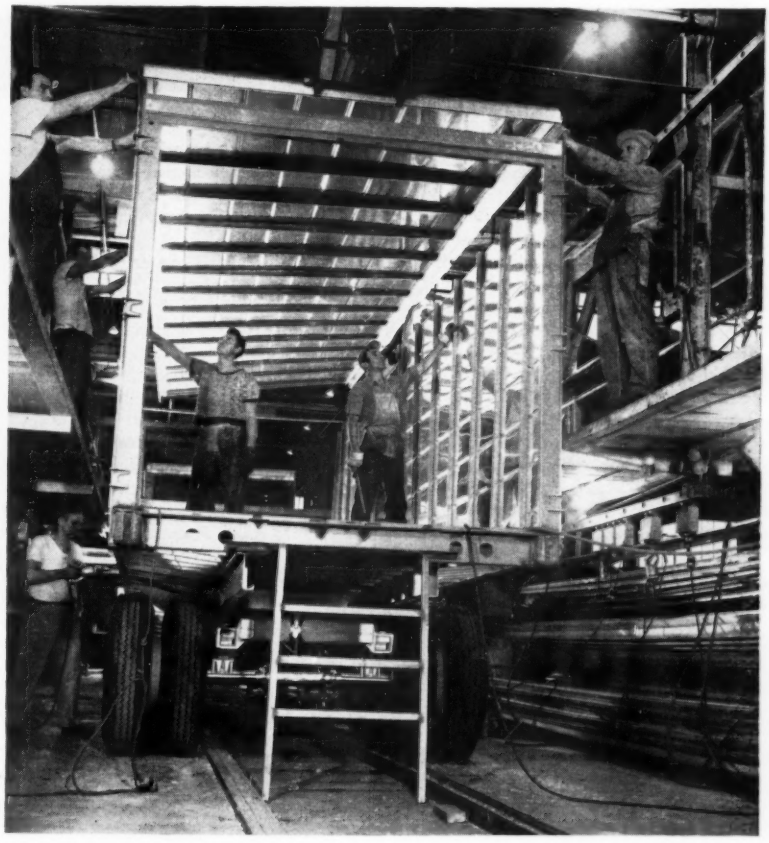
By March 1953 things were in shape to start planning the switchover. This gave the production and purchasing staffs many headaches, but tooling up for the new manufacturing system was begun early in 1954. It involved designing and making or procuring some 250 different jigs and fixtures ranging up to 44 feet in length. Much of the actual changeover in the plant took place during the 2-week vacation shutdown in July.

Aside from the preparations required at the factory, it was necessary to inform Trailmobile's 53 branch offices and seven distributors in all parts of the country about CID and get them properly interested so they would do their utmost to promote it. That was done by bringing them together at five regional meetings. As CID was explained to them, they were impressed to the point of enthusiasm and spontaneously put their best sales efforts behind it.

The success of the innovation is best told by figures. By November of 1954, four months after the plan was introduced, the backlog of orders was substantially higher than it had been during the same interval in 1953. Business continued to boom, and January of this year was the biggest month both for orders and deliveries in the company's history. When the Cincinnati head office was visited in the final week of February the backlog was 60 percent higher than it had been at any time during the conflict in Korea, which was the previous peak-demand period. It was also three times greater than it had been the year before.

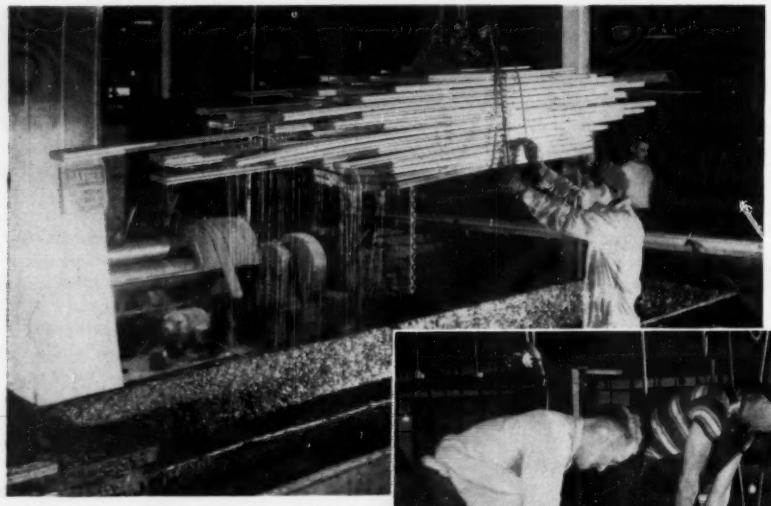
The Cincinnati Trailmobile plant is on a 25-acre site and has an area of 475,000 square feet under roof. Substantial though this is it is not too much considering the size of the product being made and the fact that 19,000 parts must be stocked in order to construct Trailmobiles under the CID system. Actually, it has been necessary in recent years to rearrange the space considerably so as to meet the increased need for production lines. Although trailer manufacturing isn't as adaptable to assembly-line methods as automobile making, there are a number of lines for the various standard components, and the general idea is to feed subassemblies to them from the sides.

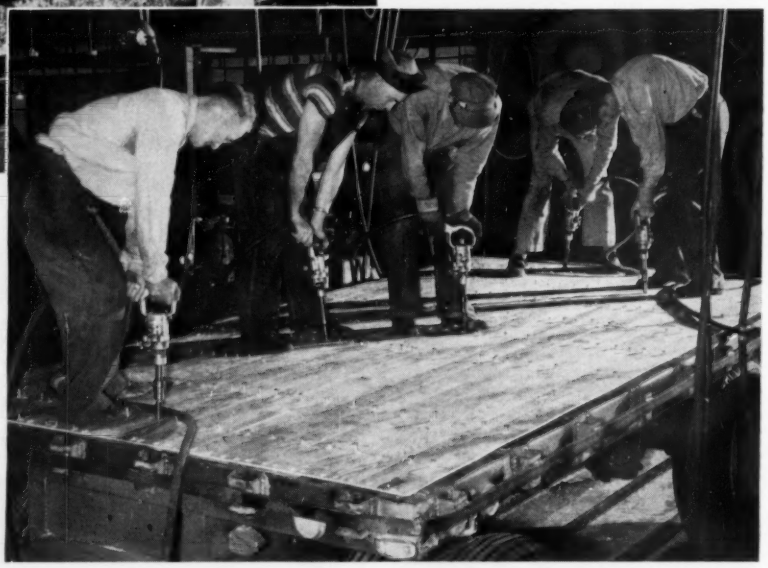
Through careful planning, more effective stacking and other measures, more



PUTTING BODIES TOGETHER

In making up one side of an average-size van-body trailer, around 700 rivets are driven to fasten the panels of sheet metal to the reinforcing frame. This is done with air-powered hammers (above). Platforms are provided on both sides of the assembly line (right) and men work inside and outside when roofs are put on bodies that have already been mounted on wheels.





AN OAK FLOOR GOES IN

Oak is the wood most used for flooring. Seasoned, kiln-dried stock is made up in tongue-and-groove boards up to $1\frac{3}{8}$ inches thick. The lumber for each floor is cut to length and tied in a bundle, ready for use when it is needed. A bundle is shown at the left emerging from a vat containing a preservative. Two screws are put in each plank at every cross member of the frame, and the total sometimes reaches 900. Holes are drilled and screws driven with air-powered tools (below).

than 100,000 square feet inside of buildings formerly used for storing raw materials is now given over to manufacturing. One structure, 83 percent of which was set aside for storage in 1943, is now utilized almost entirely for production. Under the revision, most of the raw materials that are not harmed by exposure are kept outdoors close to any of the five buildings in which they are required.

In the rearrangement, space was allotted to a department for research and development, which is of continually growing importance. One of the recent activities along this line was the sponsoring of wind-tunnel tests at the University of Maryland to show that streamlining a trailer to cut down wind resistance can reduce the fuel bill for towing it by as much as $375 a year. The production lines also underwent streamlining, with the result that much backtracking—unnecessary movement of assemblies from one building to another in order to complete them—was eliminated. In virtually every case the flow of work has been straightened and lost motion and confusion lessened. In one instance, a line was shortened from 1012 to 503 feet through reorganization.

In general, the assembly of a van-type trailer starts with the chassis or underframe. After it has been fabricated and painted, it gets its wheels and tires and moves on to receive the proper body, which is then finished inside as called for. This may involve lining it with plywood and insulating it with from 1 to 6 inches of glass wool. A specification sheet accompanies the growing unit on its trip.

The finishing operations, which include putting on brakes and lights, painting the entire vehicle and aligning the wheels, may consume anywhere from 8 to 40 hours, during which time the van is off the line and parked in a stall at the side. The factory normally installs only such lights as are required by the state where the trailer is to be used, but the customer may add others later. Similarly, Trailmobile paints the unit any color desired but, unless requested to do so, doesn't put on the owner's name or other lettering.

Body superstructures are assembled in their own department, the line being split into one for steel and another for aluminum. Reinforcing members for side panels formerly consisted of a series of diamond-shaped frames made by bending and welding together metal channel sections, but under the revised CID specifications they are composed of straight channels put together to form rectangular patterns or a bridge-type truss structure. These frames are supported in jigs at a slight angle from the vertical while the side panels are riveted to them. Sides of many different constructions are available to meet the varying uses to which a van is put and can be had in a wide range of heights and lengths, the latter up to 44 feet.

In another kind of side structure, known as the integral post, the framework is embodied right in it—posts are formed by overlapping the panels. The latter are welded together and a top rail is welded to them at the same time. This operation will soon be done on a new fixture containing automatically cycled welding equipment. From there the completed units will be transferred to a pneumatic lift of the automobile service-station type where alternate ones will be turned so that right- and left-hand sections may proceed in pairs to the next station. Roofs are made up on horizontal fixtures 44 feet long that accommodate units from 22 feet upwards. To facilitate putting them on the side and end panels, the latter are depressed in a pit so as to place the work at a convenient level.

Portable tools, powered either by compressed air or electricity, are of aid in performing many of the assembly jobs and are frequently indispensable. Pneumatic types are used for drilling, reaming, grinding, riveting, driving screws and scaling flux from weldments. Several of these operations are illustrated. Power for the air tools is supplied by compressors totaling 450 hp. The plant has more than 1200 of these small tools, which have received increased care since the CID plan boosted output. As operations were speeded up it was noticed that production suffered at times because the right tool was not immediately available or not in good working condition.

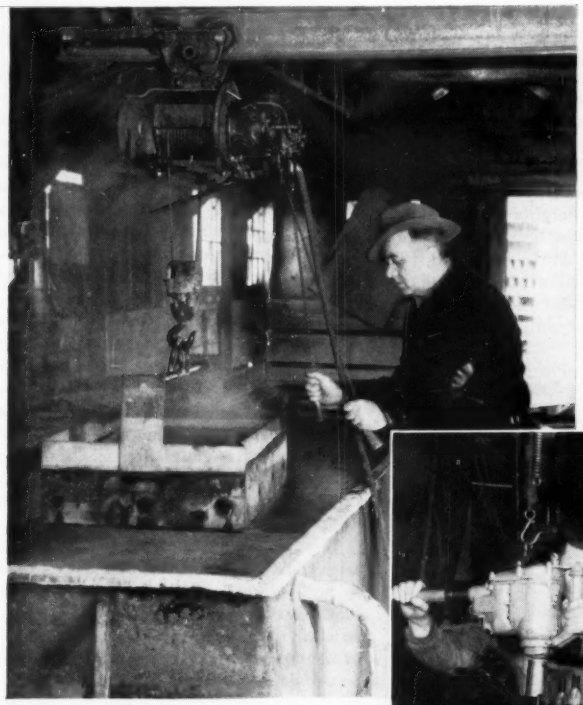
So a portable-tool program was initiated to remedy the situation. As soon as it was well underway it became apparent that a few new tools were needed and that many of the ones on hand required attention.

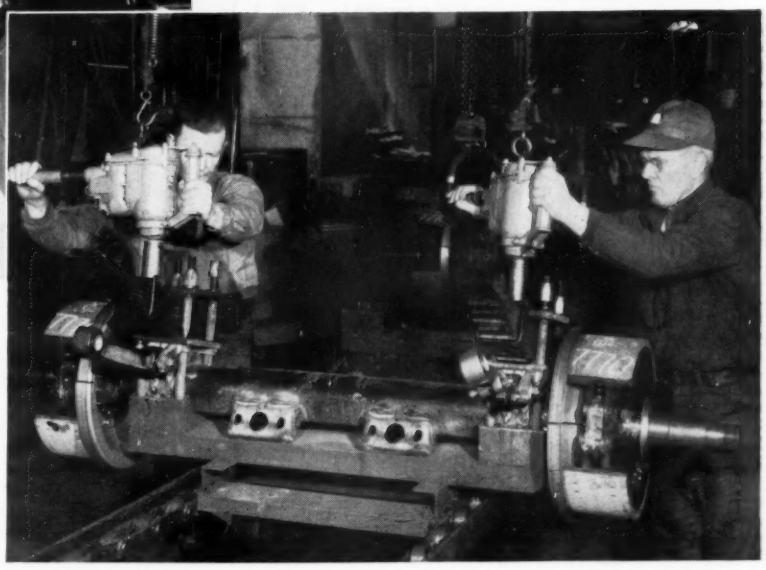
In a factory such as this one it is not feasible to suspend tools from overhead balancers, as is usually done in many other assembly-line operations. Instead, they are often laid aside after use and it is difficult to keep close track of them. It was found that men on one shift sometimes secreted the best tools or those in the best condition so that they would be sure to have them during their next working period. The relieving shift was consequently at a disadvantage, and frequently reported a shortage of tools that didn't exist.

To make certain that all tools would be put in good working order, a central master crib was established and equipped for making major repairs. Two competent repairmen were placed on duty there, one to handle air and the other electric tools. In the beginning, reconditioned tools were not given out unless requested, and by retaining them a "bank" that now contains 150 units has been built up. Today, when a tool comes in for repairs it is normally exchanged for a similar one taken from the bank. Having learned that it is easy to get tools that are in good condition, workmen are quicker to turn in faulty ones. In addition to the main crib, three others have been set up in different buildings where tools can be brought for minor repairs and adjustments.

When a tool reaches the main crib it is stamped with an identifying number, and essential information regarding it is entered on a card. In this manner an inventory is gradually being taken. So far it has revealed 118 different models. In fifteen of these categories there are three or fewer tools; in 43, only one tool. Through these records the tool department will, in time, not only find out which are used most and which stand up best but also obtain other pertinent information. A move will then be made to reduce the number of models in service—to concentrate on those that perform best and show the lowest maintenance cost. As old tools come in for repairs, or those that are obsolete in the sense that their manufacturers have replaced them with later and more efficient units, they will be carefully examined and, if their condition justifies it, they will be discarded rather than buy new parts for them.

Trailmobile's aim is standardization which, in the case of air tools, includes hose lines and connectors. Other primary objectives of the program are: to improve preventive maintenance by providing adequate filters and lubricators in air lines serving tools; to set up a competent organization to control the use and repair of tools; and to fix responsibility for their care while they are on the job, making certain that they are performing to capacity ratings and seeing to it that they are properly put away when not in service. With this program in effect, management will be able to determine immediately whenever a new production line is planned what tools, if any, will have to be purchased.





VARIOUS USES FOR AIR POWER

Two Size 538 Impactools (right) save time in running four nuts on two U bolts that hold the springs to the axle and also make sure that all will be tight. A smaller Impactool, a Size 514 with an extended spindle, is shown at the upper-right running retaining nuts on ten bolts of a Budd-type wheel. Above, a Size B Ingersoll-Rand air hoist with a rope pull of 1000 pounds works dependably in a corrosive atmosphere over a pickling tank.

Dry Compressed Air

It's mandatory in jet planes, desirable in many industrial processes

BETTY S. WELCH

My Icarus! he (Daedalus) says; I warn thee fly
Along the middle track: nor low nor high;
If low, thy plumes may flag with ocean's spray;
If high, the sun may dart his fiery ray.

—OVID

MAN seems to have been concerned about the problems of high-altitude flight since Icarus got into trouble by flying too near the sun. You may remember, if you studied mythology, that Daedalus, to escape from King Minos, equipped himself and his son with wings made of feathers partly held together with wax. Failing to heed his father's warning, Icarus ventured so high that the intense heat of the sun melted the wax and, losing his wings, he crashed to his death. High-altitude problems are still with us, and will be until we fulfill the age-old dream of flight to another planet. Then "high altitude" will become "interplanetary space" and we will have interplanetary-space problems.

Temperature extremes still present a major difficulty. About 16 miles is man's farthest flight to date, and while that altitude is hardly enough in relation to the 92,000,000 miles to the sun to result in a repetition of Icarus's troubles we certainly hear a lot about the "thermal barrier" to high-speed flight. The temperature rise attributable to compression of the air, in combination with that caused by skin friction, both of which increase as the square of the speed of flight, results in heat that will not only melt wax but will seriously impair the strength of the light alloys usually used in air-frame construction. The thermal barrier is being pushed back through the development of new alloys and cooling techniques, and it seems probable that aircraft will continue to fly faster and faster, with the end nowhere in sight.

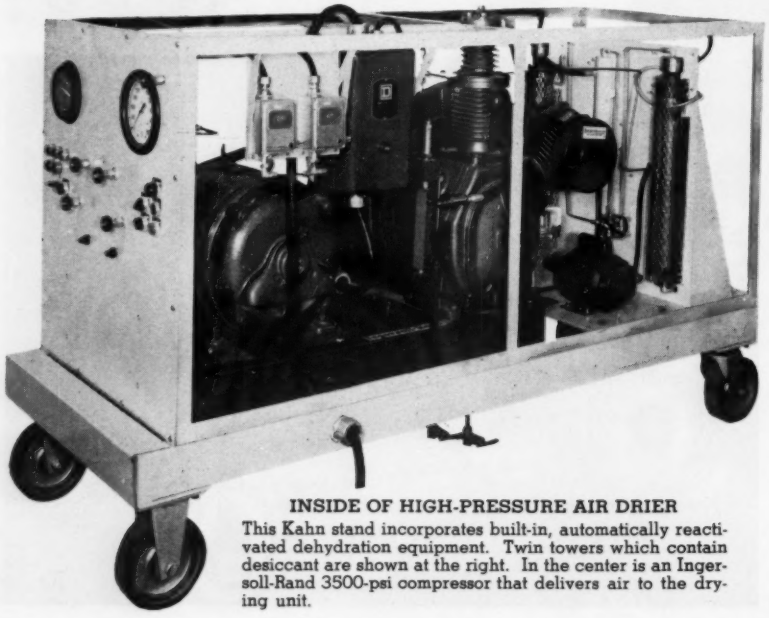
At higher altitudes we are confronted with the problem of cold instead of heat. There skin temperature is lower because the air is thinner and causes less friction as a plane passes through it. In general, the air gets colder as height increases until a point about 6½ miles up is reached. From there on to a very great altitude the temperature remains substantially constant. The average value for this constant-temperature region is 67° below zero Fahrenheit, though temperatures as low as 85 or 100° below are not uncommon. At extreme heights the air is so thin that the distances between the molecules of air become of the same order of magnitude as the sizes of the airplane components, and under these conditions it is hard to say how temperature should be measured or even exactly what it is.

ICARUS PLUNGING TO EARTH

Low temperatures at high altitudes present their own set of problems to the airplane designer and operator. In this article we shall consider but one of these and its solution. Jet aircraft designers are turning more and more to pneumatic rather than hydraulic actuation of instruments and controls because tubing can be much smaller with air and no return lines are required, the air being exhausted to atmosphere after it has done its job. And logistics problems are simplified, because no special fluid has to be transported to distant airfields. Air can be compressed to take up very little space and it is much lighter than hydraulic fluids. And anyone in the industry who can save space or weight is a happy man.

When a pneumatic system is used, an airport-based compressor cart is rolled up to the plane and the receiver or bottle on the latter is pumped full of high-pressure air, the pressure varying with different types of aircraft. The size of the receiver depends on the pressure and also on the amount of air that will be needed. In general, with new planes performing more functions with air than older ones, the size of the bottle has increased. One type in large production is equipped with a receiver having a capacity of 1000 cubic inches. The stored air does such jobs as ejecting the canopy for an emergency bail-out, operating gun-firing mechanisms, or jettisoning expendable wing fuel tanks, as well as actuating controls and instruments.

A small lightweight compressor is usu-



INSIDE OF HIGH-PRESSURE AIR DRIER

This Kahn stand incorporates built-in, automatically reactivated dehydration equipment. Twin towers which contain desiccant are shown at the right. In the center is an Ingersoll-Rand 3500-psi compressor that delivers air to the drying unit.

ally carried aboard to restore the pressure as the air is consumed. In machines designed for this service, ruggedness, high flow and long life are purposely sacrificed for small size and lightness. If the unit were used to fill the receiver initially, the charging process would be tedious and the life of the compressor too short to be practical. The bottle-plus-compressor system works fine; but the problem that concerns us is what happens to the air in a plane's pneumatic system or storage bottle during flight.

Let us say that the air receiver is filled on the ground on an average sunny day with low relative humidity. The air will contain some water vapor, perhaps 4000 ppm, or 4000 pounds of water per million pounds of air. As the craft climbs and the temperature falls the moisture content remains the same but the air is less and less capable of maintaining it in vapor form and the relative humidity increases steadily until it reaches 100 percent. That will occur at about 34°F for the 4000 ppm with which we started.

If the plane continues to gain altitude and the temperature to drop, the moisture will be precipitated out as water which will, of course, congeal when the temperature falls below the freezing point. Now we have ice in the pneumatic system. This could have a variety of consequences, none of them good and some of them disastrous. Instruments might fail to function, flaps jam, landing gear refuse to come down after descent, or the arresting hook of a carrier-based machine could remain retracted and cause ditching.

Serious trouble may be experienced with moisture contents considerably lower than the 4000 ppm present on our warm, sunny day. If the craft is charged with air containing 750 ppm the frost point will be reached at zero Fahrenheit and the water vapor will freeze and plug the air lines. This will happen although the temperature is still 5° above the dew point, or the point where the vapor would condense out as water. To get a frost point of –67°F, the amount of moisture present in the air used to fill the pneumatic system must not be more than 13 ppm, while a content of only 5 ppm will result in a frost point of –80°F.

The situation will be aggravated if the air anywhere in the system undergoes expansion and, in consequence, a drop in temperature, for that will cause it to become even colder. This effect is the basis of the familiar problem of carburetor icing. The obvious solution of this high-altitude difficulty is drying the air for the pneumatic system, and that is being done automatically by means of the unit shown in the accompanying pictures. It is one of the types of dehydration equipment designed and built by Kahn & Company, of Hartford, Conn.

High-pressure air enters the unit through a mechanical moisture separator, which picks up the entrained droplets of water or oil. The air then goes to one of two identical towers which contain a specially prepared desiccant that absorbs virtually all the remaining moisture. Next, it passes through a dust filter which removes any particles it may have picked up from the desiccant, and thus the high-pressure air as it leaves the outlet is clean and dry.

AIRPLANE AIR RECEIVERS

The new Kidde Fiberglas container for high-pressure air shown at the right weighs 12¼ pounds, as compared with 20½ pounds for the wire-bound steel sphere at the left. Both have capacities of 650 cubic inches.

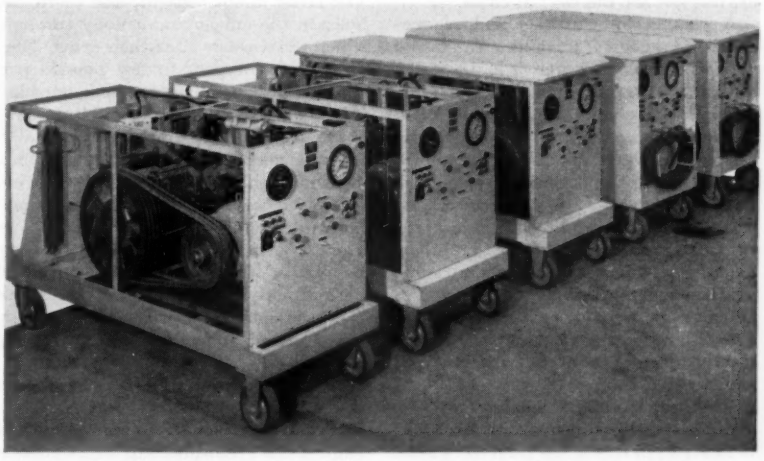
After a tower has been in operation for a time the desiccant becomes spent and will no longer absorb most of the moisture. The unit's automatic sequence timer then opens and closes the proper valves so that the incoming air will be directed through the other tower while the desiccant in the first one is reactivated. This is accomplished by heating the tower electrically. As soon as it goes off the line a heater is turned on automatically and remains on until the desiccant reaches the optimum temperature for reactivation, when it ceases to function. The hot air is forced through the desiccant by a small blower to expedite the process. When completed, the tower is ready to serve again. The dehydration equipment is available also with manual controls. In that case the operator turns the heaters and blowers on and off and manipulates valves to direct the air from one tower to the other.

In addition to filling pneumatic systems, the aircraft industry uses dry air for starting the new jet-powered planes. For charging, air at pressures up to 3000 psi is required, but a relatively low quantity is needed for this purpose because the capacity of the pneumatic system is not large. Jet-engine combustion starters, too, use high-pressure air. In low-pressure jet starting, however, a very high rate of flow must be maintained for a short time.

But it is not only aircraft instruments that utilize air to transmit measurements from the points where they are taken to indicators where observers can read them conveniently. Process industries are resorting more and more to pneumatic actuation in their instrumentation and are drying the air to insure accurate, consistent transfer of the quantities measured to distant dials.

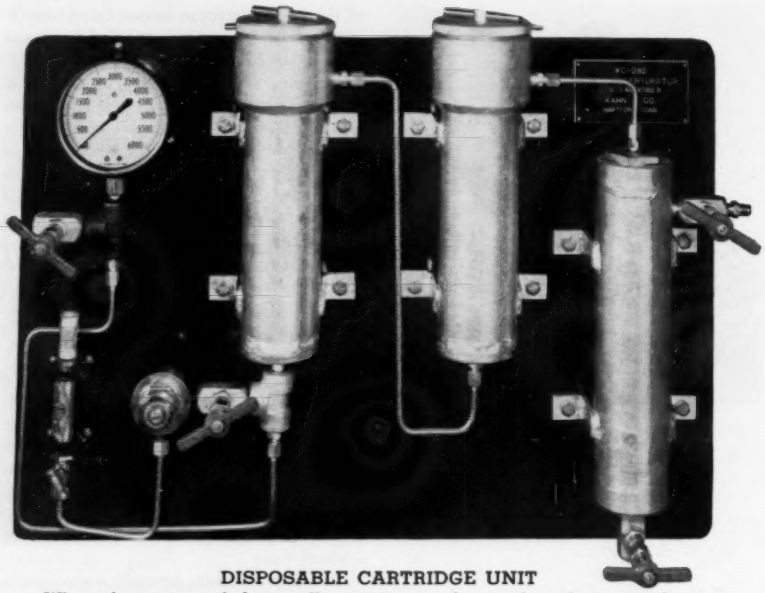
Shop air has been used for many years to operate drills, riveting hammers, grinders, borers, saws, and other tools. But it is only recently that foremen have discovered that an installation for dehydrating the air will soon pay for itself by lengthening the life of the tools and reducing down time.

There is another need for dry air with which our forefathers were not concerned. Television and radio transmis-



PRODUCTION LINE

Dry-air stands in various stages of completion in the factory of Kahn & Company. In addition to their primary use for filling aircraft pneumatic systems, the units are being applied increasingly in industry.



DISPOSABLE CARTRIDGE UNIT

Where dry air is needed in small quantities or infrequently, a drying unit having disposable desiccant cartridges may be used. Because no electricity is required to provide heat for reactivation, the first cost is reduced and the unit is suitable for operation in hazardous atmospheres. Referring to the picture above, air enters a moisture separator at the right, then passes through the two cartridges in sequence.

sion lines have coaxial cables which consist of one round conductor inside another with spacers in between to keep them from touching each other. Air serves as the insulator. If the air is wet, the current may leak between the conductors. I think we have all learned the hard way that damp air will conduct electricity while dry air will not. It is only on cold, dry days that we may find touching a car-door handle or other metal object a shocking experience. Usually the moisture in the air will dissipate this static charge, leaving the handle and us at the same potential. That is fine for us, but not for the coaxial cable.

A solution that was tried, and was successful to a degree, was filling the cables with nitrogen. However, it had one disadvantage: the nitrogen leaked out because the lines are not gastight and had to be replaced. This proved to be expensive. Dehydrated air has been found to be better for the purpose. It is pumped into the cables at low pressure, and while it escapes in time an automatic control restarts a compressor to fill them again. Such installations make our radio listening and television viewing pleasant. But in airport radio-control towers they are still more important because the clear transmission of information may save lives.

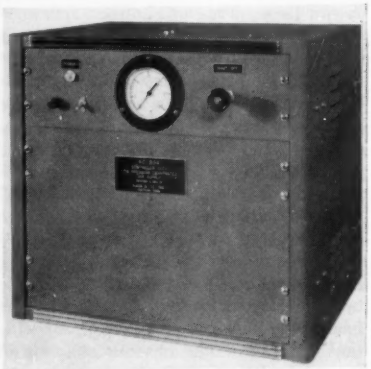
The problem of the conductive properties of moisture in air was with us long before TV, in fact it has been recognized for some time that dampness affects the performance of electrical components. Therefore it has been the practice to seal them hermetically so their operation will not vary with changes in their environment. If water vapor is sealed into a component the purpose of sealing is defeated. For this reason parts such as transformers have been baked until all moisture was driven out before they were sealed.

But today we are making electrical and electronic components which would be injured by such baking. Here again the solution is dry air. Where parts such as transistors, for example, are being assembled and sealed, a dehydration unit of the type described supplies dry air at low pressure to an enclosed work space. The latter is not airtight, and there are holes in the enveloping canopy through which the workers stick their arms. Dry air at low pressure (a few pounds per square inch above the pressure outside) is introduced into the area and leaks out, thus pushing out all the moist air initially in the enclosure. Of course outside damp air cannot enter because the pressure inside is higher than that outside. Components sealed under these conditions are dry and will remain dry, with no possibility of corrosion or impairment of performance through moisture. Similar arrangements have wide application in the electronic, chemical, and processing industries.

Air is only one of the gases which are compressed and put to work. Nitrogen and others are being used increasingly to control the atmosphere in which metals are heat-treated. Here, too, the removal of moisture is required. Sometimes dry air is needed in small quantities or infrequently, and in cases of that kind a unit of the disposable-cartridge type should be considered. The first cost of the latter is less than that of the reactivating type, but the price of the cartridges may be an important factor. Another consideration that may lead to the choice of this form of dehydration is the fact that no external source of power is required. The disposable-cartridge type can be used anywhere without regard to electricity, and this is, of course, an advantage in explosionproof installations.

One of our illustrations shows a disposable-cartridge unit which operates as follows: Air comes in at the right through the moisture separator, which has a manual drain at the bottom. Next it enters the first cartridge at the top, passes through the desiccant bed and out at the bottom into and through the second one. The length of time a cartridge will remain effective depends on the temperature of the air that is being dried. For that reason a dew-point indicator is usually used. When this instrument shows that the outlet air is approaching the specified dew point the first cartridge is discarded, the second one is moved to first position and a new one is put in its place.

Current research at Kahn & Company is directed towards producing a desiccant for disposable-cartridge equipment that will work at temperatures above 130°F—the present effective limit; towards the design of valves that will make for fully automatic reactivating units above the 5000 psi pressure for which equipment of this type is now recommended; and towards techniques that will bring the frost point below the −70°F now achieved. This research has been undertaken so that when requirements for dry air become more stringent, equipment to meet the most rigid specifications will be available.



LOW-PRESSURE AIR DRIER

This unit will dry air at conventional industrial pressures and is coming into considerable use in connection with such applications as assembling transistors or other electronic components, filling radio or television coaxial transmission cables and in processing work where low humidity is demanded.

This and That

International Language Tried Out

In 1951, Science Service introduced a polyglot language called "Interlingua" for the international communication of scientific information. It is said to be readily understandable by anyone who is able to read technical material in any major European language because it combines word forms that are common to them. The first use of the new medium of expression in a general scientific periodical was made in the March issue of *Research for Industry* published by Stanford Research Institute, Stanford, Calif. It was mailed to all Europeans on the circulation list and they were asked to give their opinions about the innovation. Interested persons may obtain a copy by writing to the institute.

* * *

Driving Snow Poles

The California Division of Highways has determined that snow poles can be driven four times as fast with air hammers as with hand sledges. The 10-foot steel rods are forced into the shoulders of mountain highways to mark the limits of safety for vehicular traffic when the surface is obscured by snow. In the district where comparative tests of the two methods were conducted, approximately 150 miles of roads are flanked with some 9000 poles. These were formerly driven by hand, all within a period of three weeks, and crews of three men each averaged around 150 a day. In the hardest material it sometimes took up to fifteen minutes to put a single rod in place.

In the case of air power, a platform was erected on a dump-body truck and provided with railings for the safety of the personnel. A pipe boom was erected in one corner as a means of suspending a paving breaker fitted as a pile hammer and traveling in leads that kept the pole plumb during driving. With this equipment, the number of poles handled daily averaged 600, and the job was completed in 50 instead of 200 man-days.

* * *

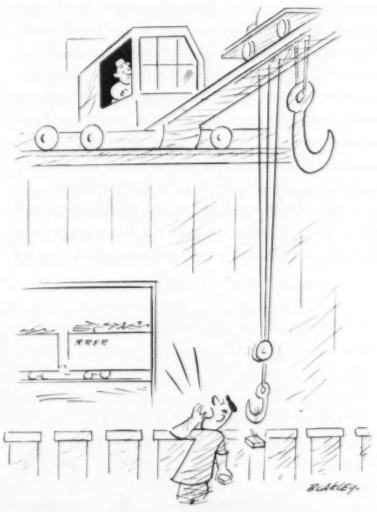
Planes That Fly Vertically

In our April 1955 issue we mentioned that Bell Aircraft Corporation has developed airplanes that can take off and land almost vertically with the help of jets of gas blown out of wing edges and tips. Along similar lines, Lockheed Aircraft Corporation, of Burbank, Calif., is building a jet training plane for the U. S. Navy equipped with an air-blowing device that will serve the same purpose. Lockheed engineers report that "highly compressed air is delivered from the jet's engine into a tube which runs inside the trailing edge of the wing and is blown through slots in the tube and out over the wing flap and aileron." It is said that this tends to make the normal flow of air over the wing hug the skin surface, thus increasing the craft's lift and delaying any tendency to stall. The new plane, called the T2V, will be the first 2-place jet trainer designed for use both on seagoing carriers and on land.

* * *

Nations To Trade Power

The English Channel is one of the busiest stretches of open water, and often one of the roughest. On its surface ply numerous craft, many of which are engaged solely in transporting goods and passengers between England and France. A subaqueous tunnel connecting the two



"Are you the salami with mustard?"

countries would doubtless prove advantageous, but at the moment the long-proposed scheme seems even farther from reality than when it was first advanced.

There is, however, a possibility that the electric-power systems of the respective nations may be linked by means of cross-channel underwater transmission lines. Since 1950 the project has been examined closely by a joint board representing the power authorities concerned, and according to reports published in *The Engineer* (London) the scheme is feasible. Because the peak loads in the two countries come at different hours of the day, the interchange of current would make it possible for each to help the other at times of greatest need. This would increase the potential of both systems and assure the fullest and most economical utilization of their installed equipment.

* * *

Growth of Industrial Television

There are now between 1200 and 1500 industrial television installations in the country, and much greater use of the circuits in working places and even homes is forecast. Speaking before the American Power Conference in March, Robert H. Johnston, of the General Precision Laboratory, Inc., outlined four favored areas of application. Examples are: 1– Where the object or operation observed is too far away to be seen directly, such as railroad cars in a switching yard, shoplifters in a store, blueprints in a central drafting room or signatures in a bank. 2– In locations that are dangerous by reason of radioactivity, explosions, or proximity to the rear of airplane jet engines. 3– For educational viewing of activities in rooms too small to accommodate sizable audiences, as in the case of students watching a surgical operation. 4– For economy, as in the power industry, where one man can control several substations by having images of their meters before him on the TV screen. A suggested home use is keeping an eye on children in a nursery from another part of the house.

* * *

Diving Efforts Fail

Repeated unsuccessful efforts by divers to reach and open a valve submerged in 230 feet of water in the Osceola copper mine in Michigan have complicated the problem of reopening the long inactive property.

The valve is on a pipe line that passes through an underground dam between the Osceola workings and the adjacent Conglomerate lode. If they could have opened the valve, about 202 million gallons of water between the 25th and 28th levels would have flowed through the pipe into the Conglomerate property and then been lifted to the surface by pumps in the vertical Tamarack No. 5 Shaft which intersects the Conglomerate lode. But because that course could not be followed, the Osceola will have to be dewatered more slowly by means of specially constructed submersible pumps placed in its inclined No. 13 Shaft.

Navy and professional divers made five attempts to reach the valve by traveling 362 feet down the incline between the 25th and 28th levels in a mine car

and then walking 140 feet to the valve location. The maximum time a man can safely endure the 100 psi water pressure at that depth is 30 minutes, which proved to be insufficient to do the job. R. L. McKenzie, a Navy diver, came the closest, but he was still 105 feet away from the valve when he had to quit. The divers breathed compressed air on the first three tries. During the final two they were fed a mixture of helium and oxygen, which is less likely to bring about an attack of the bends. But even this expedient failed to enable them to remain underwater long enough. Debris clogged the level and made walking difficult and threatened to sever the breathing lines.

The divers descended in pairs, and after reaching bottom one of them unwound a cable from a reel as he went towards the valve. The plan was to crack the valve open, to affix a reel to it and to that end of the cable and then go back to the mine car. The valve was to be opened fully by giving its reel 26½ turns through the pull exerted on the cable as the mine car returned to the surface.

New Drill Combines Three Units in One

A NEW self-contained "three-in-one" blasthole drilling rig has been introduced by Ingersoll-Rand Company. Called the Drillmaster, it will put down holes of more sizes and to greater depths than any single drill previously available.

The highly adaptable air-powered machine can be operated in any one of three different ways and is therefore suitable for use in quarries, open-pit mines and on all heavy excavation jobs in construction work. Its attack is so varied that it can meet almost any rock condition satisfactorily.

The Drillmaster is a 16-ton, mobile, crawler-mounted, tower-type drill that carries an Ingersoll-Rand Gyro-Flo 600-cfm air compressor to furnish power for the propulsion and drilling machinery. It can negotiate a 30-percent grade unaided, and the 30-foot 7-inch tower can be laid back when traveling. Hydraulic leveling jacks right the machine to the desired vertical drilling position and hold it securely on sloping or irregular terrain. It uses 20- or 25-foot drill rods which are handled with the aid of a rod changer and a Utility air hoist. Rods are coupled together for deep drilling, and the drill and rod are fed downward under controlled pressure by a piston-type air motor acting through a chain. This feature, plus independent rotation, is of assistance in fighting a tight steel.

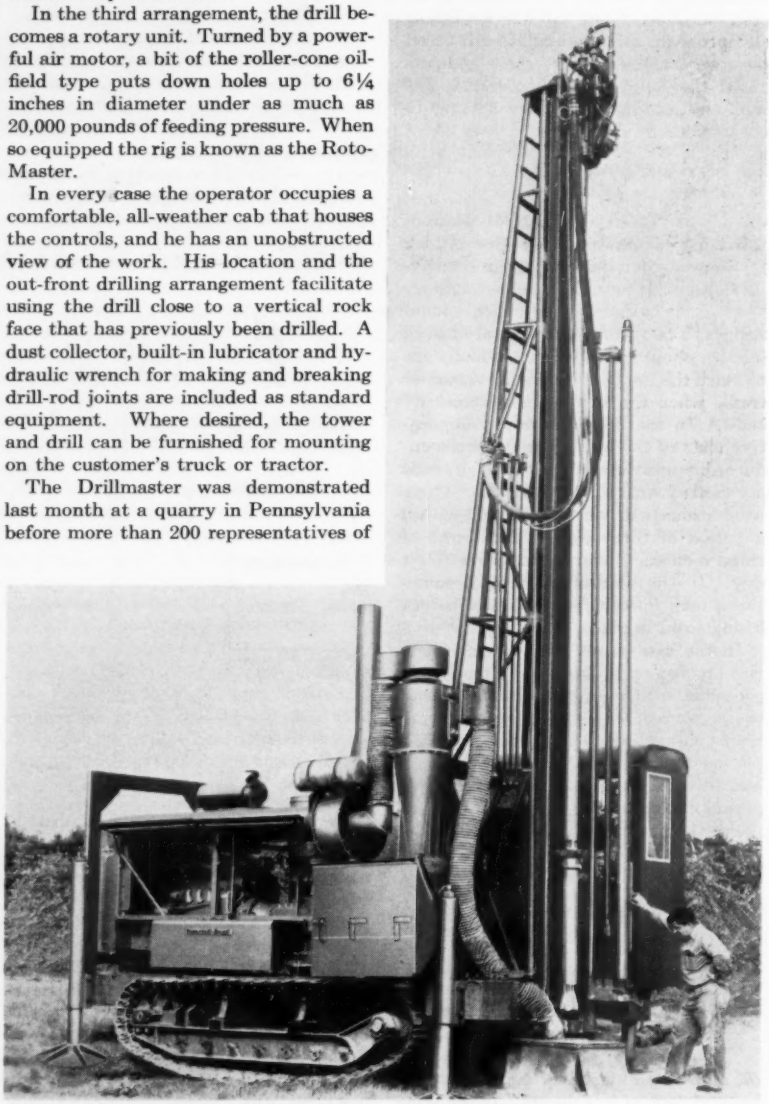
In its triple role the machine can be equipped with a new and revolutionary down-the-hole drill, with a new heavy-duty hammer drill or with a rotary drill. When serving in the first category it is termed the Depth-Master. Then it puts down a 6-inch-diameter hole to any depth considered practicable in quarrying or mining. The cylindrical enclosed drill is small enough to pass down the hole closely behind the bit and is supplied with operating and hole-cleaning air through a hollow rod. The elimination of a long drill rod conserves energy and increases drilling efficiency.

When operating in the second category the machine is called the Power-Master and utilizes a heavy-duty out-of-the-hole drill that will put down a 4-inch hole to a depth of 60 feet. The recently designed hammer drill is claimed to have greater drilling speed with lower air consumption than any other machine in its class. It is recommended for use on construction jobs where deep holes are required. When fitted out with either of the reciprocating drills just mentioned the actual drilling element is a Carset (tungsten-carbide insert) bit, which gives maximum penetration.

In the third arrangement, the drill becomes a rotary unit. Turned by a powerful air motor, a bit of the roller-cone oilfield type puts down holes up to 6¼ inches in diameter under as much as 20,000 pounds of feeding pressure. When so equipped the rig is known as the Roto-Master.

In every case the operator occupies a comfortable, all-weather cab that houses the controls, and he has an unobstructed view of the work. His location and the out-front drilling arrangement facilitate using the drill close to a vertical rock face that has previously been drilled. A dust collector, built-in lubricator and hydraulic wrench for making and breaking drill-rod joints are included as standard equipment. Where desired, the tower and drill can be furnished for mounting on the customer's truck or tractor.

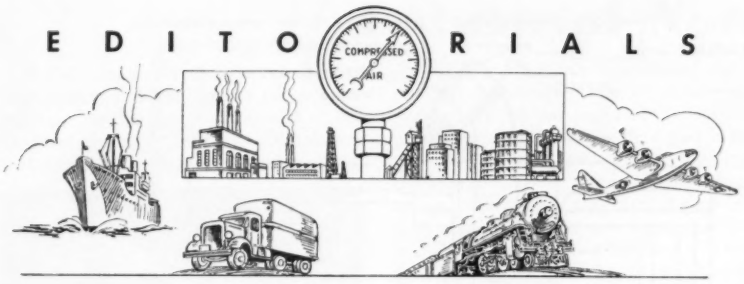
The Drillmaster was demonstrated last month at a quarry in Pennsylvania before more than 200 representatives of quarries, mines and contractors from several surrounding states. The observers were impressed to the point where they ordered several rigs on the spot.



TRIPLE-DUTY DEEP-HOLE DRILL FOR HEAVY WORK

Interchangeable drills enable this self-contained mobile rig to be used for any type of large blasthole drilling. As shown, it is equipped with a conventional hammer drill. Other drills are down-the-hole and rotary. The machine carries a 600-cfm compressor to furnish power for propulsion and drilling.

EDITORIALS



A DIFFERENT ROAD PROBLEM

CANADA, like the United States, is planning new roads, but some of them are in a far different category than ours. Comparatively, the Dominion is still sparsely inhabited; despite a current rapid rate of growth the population isn't expected to reach twenty million until 1965. In a few urban centers, Canada shares our dilemma of not having enough highways to handle the traffic, but it also has another entirely different need for more roads. Vast areas are still undeveloped, virtually unsettled and largely unexplored. Most of the land is covered with trees and muskeg, and the establishment of roadways in such country is not the simple matter that it was on our western plains when they were in a comparable stage of development.

Trappers, lumbermen and prospectors are usually the first to visit hard-of-access places. Trappers and prospectors can get around by foot and on water. Timbermen also use the waterways to float out their logs but generally require some roads, too, if their activities cover much territory. When prospectors make a strike, people flock in and new towns spring up like magic, and they can get surprisingly large without access roads. The modern mining man is air-conscious; he flies into remote regions as a matter of course, and much of his equipment is likewise flown in, although heavy stuff is normally freighted over the frozen terrain on sleds during the winter season.

Sooner or later, however, there comes a demand for a connecting traffic artery with the outside world, and that is now the case in many parts of Canada. To meet it, the Ontario Department of Mines began providing funds for building mining highways three years ago, and since then has advanced $2½ million for the purpose. The province produced $485 million worth of minerals in 1954, and the search for new deposits continued unabated with prospectors recording more than 50,000 claims.

Uranium discoveries have brought several new camps into existence so quickly that there hasn't been time to construct adequate roads into them. The new townsite of Elliott Lake in the Blind River section is being laid out for a community of 15,000, and one in the Manitowadge district is being planned to accommodate 6500. All told, the Mines Department expects to build 242 miles of highways in 1955 at a cost of $1½ million. The longest link will be 42 miles in extent to give the town of Hornepayne its first overland contact with the outside. Work will also be started on a 32-mile outlet for the town of Nakina, but that will probably be a 2- to 3-year job.

THE WATER SHORTAGE

WE ARE gradually but definitely learning that water is our most important resource. There is no substitute for it. All the world's brains have never been able to figure out how to grow things without it—how to make steel, paper or countless other daily essentials.

As old as civilization are the remains of crude irrigation works in the Near East, India and other parts of the Old World. In Arizona, too, are similar evidences that the Indians diverted water from streams to croplands centuries before the Mormons inaugurated modern American irrigation in Utah in 1847. Ancient Rome came to its glory and grandeur partly by constructing aqueducts to bring water from afar for domestic needs and to its luxurious baths.

Here at home, the East and South have heretofore been chiefly concerned with water for personal and industrial uses. Only recently have they shown a tendency towards irrigating acres under cultivation. In this respect they are about where the West was 50 years ago. In almost all sections of the country, however, growing cities have felt the pinch of insufficient water. The mushroomlike expansion of Los Angeles would have been stifled many years ago had the Metropolitan Aqueduct not been built to deliver water from the Colorado River.

There has scarcely been a time during the past 25 years when New York City has not been constructing or planning to increase its water-supply facilities. New Jersey has virtually reached the point where it can't court more industries unless it develops additional sources of water. In most industrial states where the water is taken mainly from the ground it is necessary to dig wells deeper and deeper to find it. David S. Jenkins, of the U. S. Department of the Interior, states that in some areas ground water is being withdrawn at 30 times the rate of replenishment. On both the Atlantic and Pacific coasts pumping has caused intrusion of sea water in places.

The seventeen states west of the Mississippi River are becoming more water-conscious all the while, if that is possible. Their population is up to 35 million, and the far West and Southwest are the most rapidly expanding sections in the nation. They count their wealth more in terms of acre-feet of water than in gold or dollars. Soon they may be hard pressed to cultivate enough food for their needs. Much of the West is in the grasp of drought, and swirling dust has returned to plague some parts of it. Lake Mead, behind Hoover Dam, is lower than it has ever been since it was filled in the 1930's.

Conservation is more imperative than ever before, and the accomplishments of the U. S. Bureau of Reclamation since it was established in 1902 assume greater importance with each passing year. Within the past twelve months the Colorado-Big Thompson Project, in its initial year of operation, is credited with having saved 500,000 acres of land in north-central Colorado from disaster through drought. The federal reclamation program now furnishes water to irrigate 125,000 farms and as many more urban and suburban units, comprising seven million acres on which 410,000 persons live. At least 1,500,000 others in nearby towns are dependent on the program, and two million more obtain their municipal and industrial water from works built by the Bureau. All the money it spends in supplying power and municipal and industrial water must be returned with interest to the federal treasury within 50 years. So far it has paid back $690 million, or about one-fourth of the total sum spent.

To help meet the mounting need for conservation, a Bureau-sponsored measure now before the Congress would authorize a $900-million construction project in the Colorado River basin states of Arizona, New Mexico, Colorado, Wyoming and Utah. Another bill would provide $170 million to tunnel the Continental Divide in Colorado so as to divert water from the western slope Frying Pan and Arkansas rivers to the eastern slope. Even if all the water in the western streams were impounded, there would be enough to irrigate only a small part of the tillable land, so the region must eventually import water or stop growing.

The most logical source of additional water is the sea. The oceans cover three-fourths of the earth's surface. Various methods for removing the salt content are now known, but all are too costly for general use. With the hope of finding less expensive processes, the Department of the Interior has let contracts for 24 research and development projects. Several of them have already been completed with reportedly promising results.

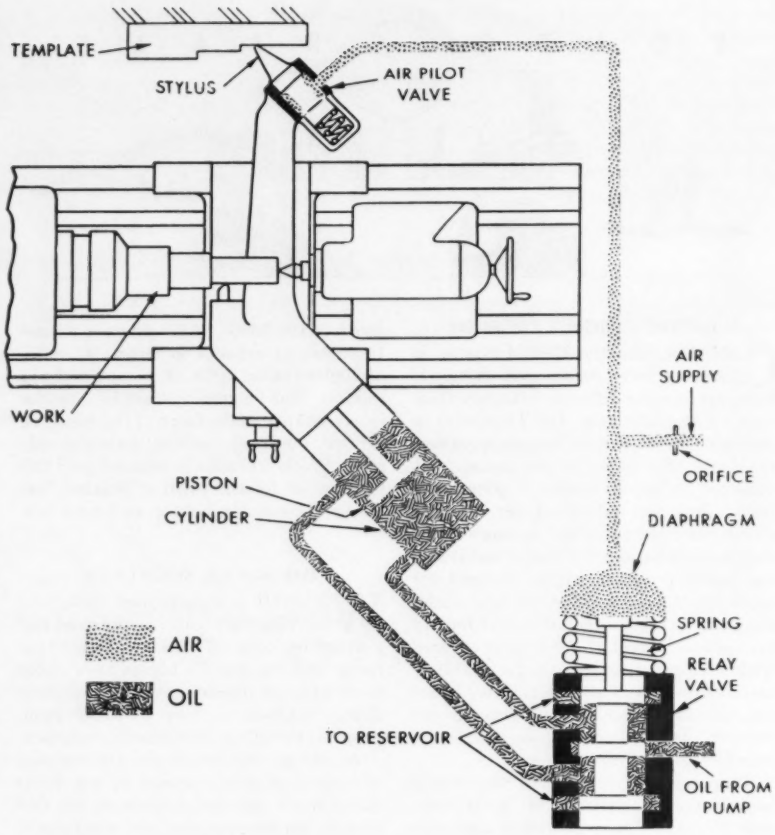
Lathe Parts Duplicated With Speed and Precision

THE Monarch Air-Gage Tracer is a simple method of duplicating lathe-machined parts on a repetitive basis and represents the company's latest development in tracer control as applied to turning machines. According to the claims made for the device, it can produce eight to ten times as much work under certain conditions as a manually operated lathe of comparative design and performs with an accuracy that exceeds anything heretofore possible on a duplicating lathe.

Combining the sensitivity of air gauging and the ease of control of hydraulic-power transmission, movement of the mechanism repeats itself within a limit of 0.0001 inch and permits machining almost any combination of diameters, tapers, bevels, forms, grooves, undercuts, shoulders, necks, radii and chamfers in a single continuous cut. For very complex operations a number of tracers and/or special adaptations can be furnished to speed up the work. The template used may be either flat or round, and because the stylus or tracing-point pressure is only 5 to 6 ounces the pattern does not require hardening to protect it against wear.

The design of the Air-Gage Tracer is based on a compressed-air circuit which acts as a servo for the working hydraulic circuit and controls the latter through a diaphragm-operated valve. The accompanying line drawing and descriptive text explain how the unit operates. The feature of the device which makes for the increased sensitivity and narrower tolerance limits is that there is no dead center or neutral point either in the air or the hydraulic circuit—no hunting or reluctance to leave a dead-center position. A limited amount of air is always bleeding to atmosphere even when the system is in equilibrium—when a cut is being made parallel to the center line of the lathe. Any change in direction merely results in the reëstablishment of equilibrium at the same rate of flow or bleeding but in a new stylus and tool position. The tracer can be attached to any Monarch lathe at the factory and can be quickly inactivated if it is necessary to operate the machine manually.

Circle 1E on reply card



HOW THE AIR TRACER WORKS

Air at constant pressure (not less than 60 psi) enters the system through the fixed orifice. As the tracer follows the template, any movement of the stylus piston immediately affects the air-circuit pressure, thus actuating the diaphragm-controlled valve of the hydraulic circuit. Then the air-circuit pressure is brought back to normal. Action of the hydraulic valve results in an increase in pressure on the work piston, either advancing or retracting it. When the condition imposed by the air circuit is satisfied, pressure on both sides of the hydraulic piston is equalized and the system's equilibrium is restored.

New Twist to Bubble Buildings

THE Garrett Corporation, at its Air Cruisers Division, Belmar, N.J., has introduced a new feature in the technique of erecting concrete structures around an inflated form, as previously described in these pages. Most of the earlier buildings were igloo-shaped, which seemed to detract from their usefulness for some purposes and also from their acceptance by architects and the public.

In the Garrett version, the outline is similar to a half-barrel, or a cup turned upside down. The sides are almost vertical and the roof is nearly flat. The building is put up in the usual manner. Against the air-filled form, made of neoprene and nylon, fine-aggregate concrete is shot with a compressed-air gun. One-inch coats are applied consecutively until the wall is 3 to 4 inches thick. When the material has hardened and become self-supporting, the form inside of the structure is deflated and removed, ready for use again.

These so-called "bubble buildings" are expected to serve as storage places, ammunition magazines, gas stations, and even as motel units and low-cost homes.

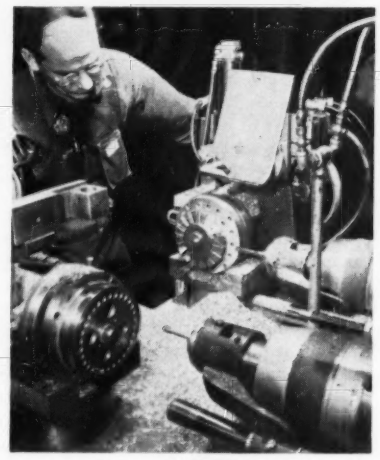
Want a White Elephant?

WENDY is a life-size mechanical elephant which has gained world-wide notice through her appearances at the Festival of Britain, the 1952 Republican Convention in Chicago, Ill., Macy's (New York City) annual Thanksgiving Day parade and at other events. The slow-moving critter is animated by means of a compressor and vacuum pump supplied with power by a small gasoline engine which consumes about 3 or 4 gallons of gasoline daily. All the machinery is mounted inside her body.

Wendy earns her keep; her services are available for $250 a day. That, according to her owner, is cheap when compared with a rental charge of $350 for a live elephant. Built as a hobby by Frank Stuart, she was bought from his estate by George Wendelken, president of Publicity Searchlight Company of New York, N.Y., for $12,000. Wendy's up for sale.

Industrial Notes

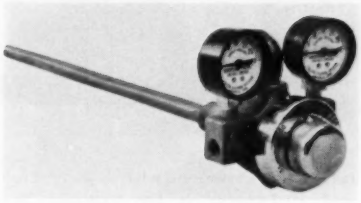
Roller pockets for bronze retainers of precision radial and thrust roller bearings are now drilled and reamed at the Rollway Bearing Company plant in one instead of two operations, with a result-



ant increase in output of 100 percent, it is reported. This has been effected by a machine tool designed by Rollway and consisting essentially of an air-hydraulic drill unit, of head and base arrangements that permit swiveling the head to change from radial to thrust drilling, and of an index plate operated by a pneumatic cylinder. Air at an average pressure of 90 psi supplied by a compressor powers both the drill and index plate; oil is the feed-control medium, the amount passing through a ball-check orifice determining the rate of feed per inch of spindle. The new unit, of which two are in service, uses carbide tools and machines roller pockets to finish size, maintaining a depth to 0.0005 inch. By attaching suitable fixtures to the work head it is possible to drill and ream radial and thrust retainers varying from 2 to 14 inches in outside diameter and from ¼ inch to 1¼ inches in drill diameter. In case of failure of any part of an electrical control circuit interlocked with the drill unit and indexing system the tool returns to the starting position without damage to itself or the work.

Circle 2E on reply card

Fultrol Pilot is the name of a thermostatic pilot controller announced by Fulton Sylphon Division of the Robertshaw-Fulton Controls Company for use in connection with valves, dampers or similar devices. Only $3\frac{13}{16}$ inches wide, the rod-and-tube thermal element of the instrument is immersed directly in the liquid or air to be kept at constant temperature. Any change activates a small pi-



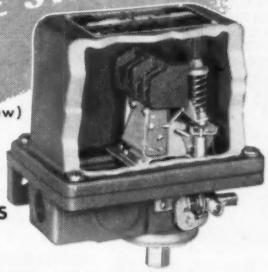
lot valve which, in turn, varies the pressure applied to a motor valve or other final control device by means of which the medium is either cooled or heated, as required. The unit is designed to regulate temperatures in adjustable ranges from 50 to 250°F and 150 to 350°, and easily read gauges indicate both pilot supply pressure and control pressure. It may be installed in a vertical, horizontal or diagonal position and used with compressed air, water or any clear low-viscosity hydraulic fluid. The instrument is suitable for service where rapid response and accuracy are considerations such as in electroplating, dyeing and bleaching and chemical processes.

Circle 3E on reply card

Straight lines characterize a new heavy-duty pneumatic clamping device recently announced by Van Products Company. Powered by means of spring-

EXPLOSION-RESISTING PRESSURE SWITCH

(cutaway view)



FOR AIR COMPRESSORS AND PUMPS USED IN HAZARDOUS LOCATIONS

THESE FEATURES ADD UP TO A BETTER SWITCH:

- 200 lb. range and usual differential for air compressors and pumps
- Tamper-proof adjustment
- "Power-house" over-center spring fixed for positive action regardless of switch adjustment
- Externally mounted release valve protects against corrosion of internal parts

Also available in WATER-TIGHT construction

Write for Bulletin 9013-G.
Address Square D Company,
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SQUARE D COMPANY

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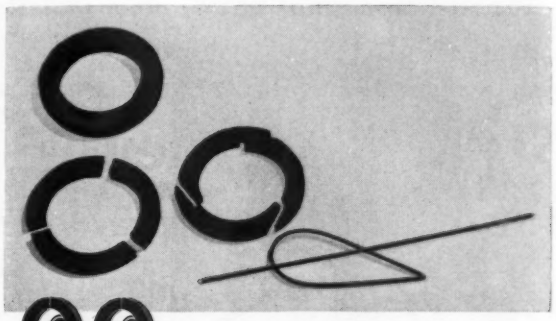

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Whatever your packing-ring requirements, you can depend on Cook for a ring *design* and ring *material* that will deliver maximum efficiency at minimum cost.

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(For Non-Lubricated Service)

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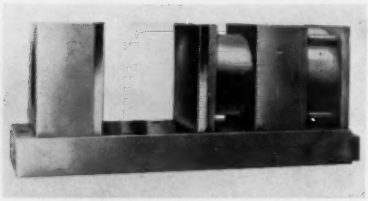


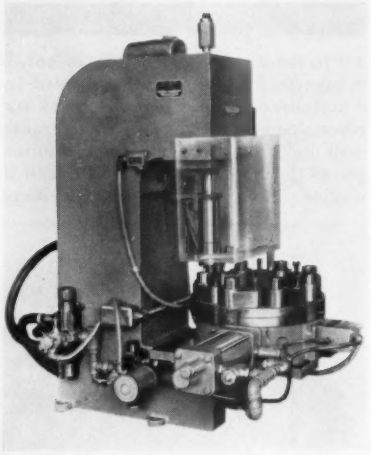
return air cylinders with 3-inch stroke and 19:1 ratio, it has 6x6-inch jaws backed by a 4¾-inch-diameter pushrod providing exceptional rigidity. Maximum work opening of standard unit is 8 inches, and stationary jaw can be adjusted to take parts up to 8 inches wide. Jaw faces are removable and can be drilled and tapped for the attachment of fixtures and dies. Known as the Vi-Speed Autovise, it can be used in any position and operated with air at up to 150 psi line pressure. May be utilized as a bench-type platen press.

Circle 4E on reply card

Workers who are continually exposed to noise of high intensity and who do not like earplugs are offered a new device designed by Mine Safety Appliances Company in coöperation with the Aero Medical Laboratory of the U. S. Air Force. Named Earsaver, it consists of a peaked cap made of cotton gabardine, of a cape of a 2-way-stretch material that covers the back of the neck and both ears and of ear cushions of a soft spongy substance. The latter are held in place by the cap and pressed against the face by the cape to insure a positive seal. This, in combination with the sound-absorbent cushions, is said to prevent the noise from penetrating. For supervisors and others there is a protector called Noisefoe. That has the cushions attached to a spring-type head suspension so it can be quickly donned and removed. The latter can be adjusted to fit any head, and the Earsaver cap is available in three sizes.

Circle 5E on reply card

Two parts of a steering knuckle are being pressed together in the plant of a car manufacturer by a production setup made by combining an Air-Hydraulics, Inc., press and index table, as the accompanying illustration shows. The entire unit is powered by standard air-line pressure and is said to have increased output from 1200 to more than 1800



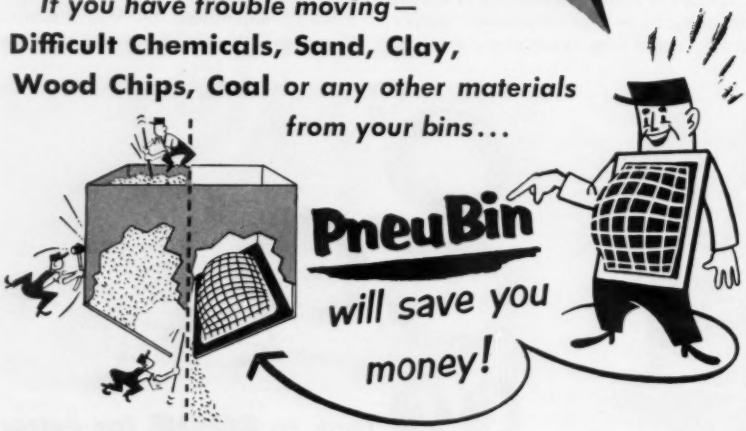
pieces an hour. The operator places the parts on the 8-station fixture in front of the transparent guard where his hands are safe from injury, indexes them into position by actuating a pneumatic cylinder and lowers the ram to press them together. The assembly is removed by a mechanical hand and chuted into a container. An electrical circuit synchronizes the action of the press and table, which indexes only on the return stroke of the ram. Cushioned stop and positive lock on the fixture prevent damage to work and tooling.

Circle 6E on reply card

Air-cylinder and hand-wheel controls that are said to expedite loading and unloading and reduce operator fatigue are features of an improved Red Ring internal-gear shaving machine offered by National Broach & Machine Company. Instead of the former manual toggle-type control mechanism, the Model GCR responds to the pressure of push buttons.

PULSATING PANELS
eliminate flow stoppage in bins!

If you have trouble moving—
Difficult Chemicals, Sand, Clay, Wood Chips, Coal *or any other materials from your bins...*



PneuBin will solve your flow stoppage problems and reduce your operating expense. The PneuBin unit consists of steel-backed, neoprene, pulsating panels mounted on the inside wall of your present bins and air controls to regulate the panels' action. By the pneumatic inflation and deflation of the PneuBin panels, the bin contents are positively displaced to insure free flow. After the panels have deflated, the air control unit (operating off the regular plant air supply) starts another cycle of inflation and deflation. The process continues *automatically* at whatever frequency is set on the air controller (this frequency is adjustable).

PneuBin decreases plant operating costs by reducing maintenance, insures constant material flow to production lines and greatly increases personnel efficiency through its quiet operation.

Send for "Flow Stoppage Report" and FREE literature. PneuBin engineers will gladly make recommendations with no obligation on your part.

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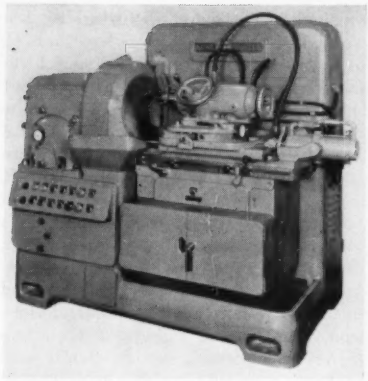


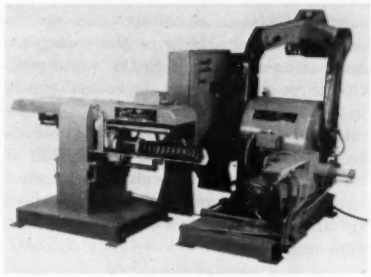
With the gear loaded in the workhead fixture, the operator clamps it by actuating a pneumatic cylinder and then advances the cutter to a stop just short of the gear by means of another air cylinder. Next he puts the cutter in mesh with the work with his left hand and orients it by turning the hand wheel at the end of the cutter spindle with his right hand. Pushing a button he starts the automatic shaving cycle. Upon its completion, the pneumatic cylinders are retracted in turn and the finished gear is unloaded. The work and cutter are enclosed by a hinged guard while operations are in progress, and all air controls are in a separate compartment directly below the electric control panel. Though designed specifically to shave internal spur and helical gears from 3- to 12-inch pitch diameter, the machine also handles gears having up to four diametral pitch teeth and face widths up to 2½ inches.

Circle 7E on reply card

Because of the closeness with which they can be mounted, miniature air cylinders are finding increasing industrial application as vises for holding small parts, as automatic work feeders and in actuating electrical contacts in test jigs and fixtures. Recently introduced by Clippard Instrument Laboratory, Inc., the unit is 2 3/16 inches long and 7/16 inch in diameter, has a cylinder bore of 0.375 inch and a maximum piston stroke of ⅜ inch. Accessory equipment includes a 12-port manifold with ⅛-inch rubber-hose connections. Both are made of brass. The cylinder is of the spring-return type and operates on as little as 12 psi pressure.

Circle 8E on reply card

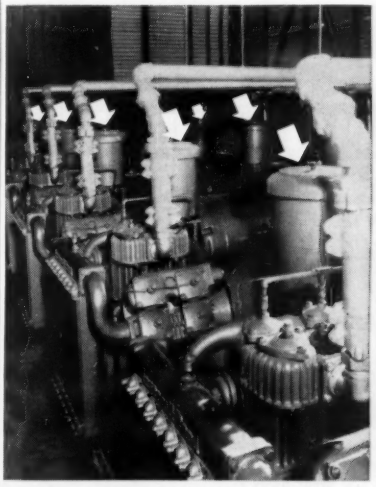
Red-hot automobile springs must be transferred quickly from coiler to quench bath to insure proper heat treatment and to do that there is now available an automatic loader designed and built by Hautau Engineering Company. As soon as a spring drops from the coiling machine into a trough on the loader and thereby actuates a limit switch, the cycle of operations starts. One air cylinder pushes the work onto a mandrel, and another serves to rotate the latter through the medium of a rack and gear until the spring is



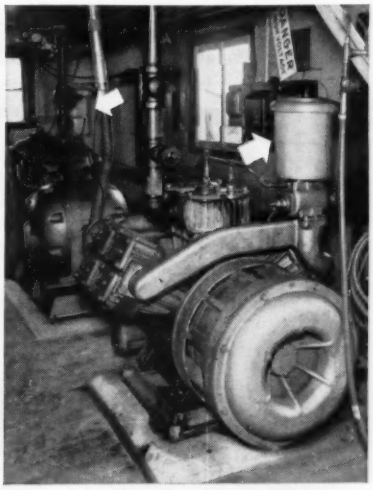
"Be careful with the explosives, boys. They're on the critical list."

Whether you drive 200-ft. piles or dig intake tunnels...

Air-Maze filters will keep your compressors on the go!



TEN COMPRESSORS SUPPLY AIR for a 200-foot pile driver used in building the foundation for a generating plant at Muskegon, Michigan. Air-Maze oil bath filter silencers scrub intake air clean in a bath of oil, keep airborne dirt from damaging polished moving parts. The silencing feature reduces strain of excessive noise on employees and neighbors.



TO HELP KEEP THIS COMPRESSOR supplying air for a tunneling project at Tonawanda, N. Y., two Air-Maze oil bath filter silencers are used. Result: reduced maintenance costs and downtime. Get the same results yourself. Specify Air-Maze oil bath filters and silencers on the compressors *you* build or buy.

AIR-MAZE The Filter Engineers

AIR FILTERS • SILENCERS • SPARK ARRESTERS
LIQUID FILTERS • OIL SEPARATORS • GREASE FILTERS

25000 Miles Road • Cleveland 28, Ohio

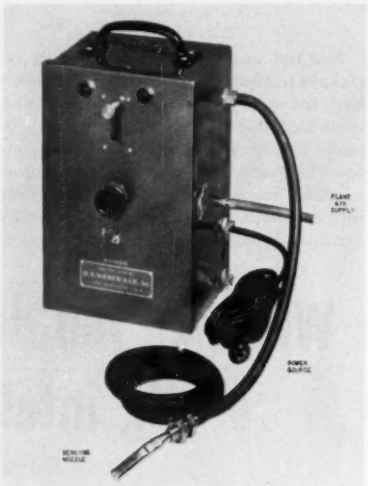
Circle 18A on reply card

oriented. Next, a clamp on a motor-driven pivoted arm grips the workpiece and, after carrying it in the same position through a 180° arc, deposits it gently in the quench bath. The loader can be adapted to handle any type of vehicle coil spring and is said to handle 700 an hour. The transfer mechanism is separate from the orientor and may be used in timed sequences with other production machinery.

Circle 9E on reply card

Quick emergency repairs of salt- or fresh-water piping are being made on board ships of the U.S. Navy by means of a metallic plastic patch that can be applied to a severed or ruptured line in 15 to 20 minutes and permits resumption of service half an hour later. So far it is used only where pressures and temperatures do not exceed 300 pounds and 200°F respectively. Tests are being made to extend its service to metal pipes carrying other liquids such as steam and gasoline. Details about the method are available from *Navy Technical News*, Office of Information, Navy Department, Washington 25, D. C.

To keep the web edges of materials such as paper, cloth and plastics in alignment while undergoing gluing, laminating, printing, or winding, H. G. Weber & Company has announced a differential-pressure sensing unit that is said to be exceptionally sensitive. The device is of the remote-control type and is operated by a metered flow of compressed air in a closed circuit with a diaphragm pressure switch at each end. One, normally closed, is set to function at ½-inch water pressure and the other, normally open, at ¾ inch. Air at approximately 1 ounce pressure is consumed at the rate of 5 to 20 cubic feet per hour. When the air issuing from a sensing nozzle is not disturbed by the web edge, back pressure is less than ½ inch and the normally closed switch remains closed, energizing the motor that shifts the roll stand to right or left. The motor continues to move the stand until the air jet is disturbed and back pressure is more than ½ inch but less than ¾ inch. At that stage the web is in neutral position, the air jet is split and both switches are open. But when the back pressure exceeds ¾ inch, the motor reverses the movement of the roll stand until the web is again in neutral position, thus making right and left alignment corrections, as needed. Units with multiple sensing nozzles are available; the one pictured has one.



Circle 10E on reply card

Blocks of cellular glass with a ¾-inch thick ceramic face are a new product announced by Pittsburgh Corning Corporation. Known as Duraface Foamglas, the material is said to have high insulating and moisture-proof properties, together with an impact-resisting surface. Standard blocks are 18x12 inches in size and 3 or 4 inches thick. They may be applied with either hot asphalt or a cold mastic-type adhesive.

Circle 11E on reply card

To facilitate handling flour in bakeries, The J. H. Day Company, Inc., is offering a machine that simultaneously sifts, aerates and delivers the material to storage bins or dough mixers. Called the Roball Airmatic, it features a sifter with a ball cleaning device that discharges the

Lehigh INC.

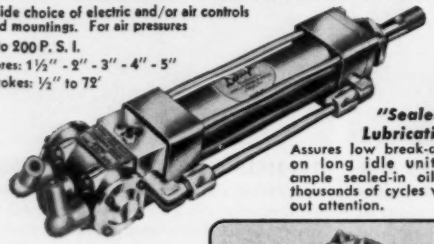
A COMPLETE LINE OF AIR CONTROL EQUIPMENT

Including precision-made HEAVY-DUTY

AIR MOTORS

WITH "SEALED-IN LUBRICATION" Pat. Pend.

Wide choice of electric and/or air controls and mountings. For air pressures 5 to 200 P. S. I.
Bores: 1½" - 2" - 3" - 4" - 5"
Strokes: ½" to 72'

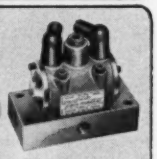


"Sealed-in Lubrication" Assures low break-away on long idle units — ample sealed-in oil for thousands of cycles without attention.

"Sealed-in Lubrication"

AIR CYLINDERS 1½" to 8" bore

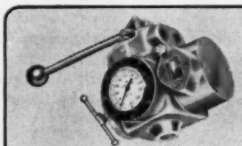
3 or 4-Way AIR POWERED VALVES



Air or electrically operated. J.I.C. Standards.

You Are Invited To Consult Our Engineering Department freely on all air automation or replacement problems. Trained factory personnel available nationally.

Write for Catalogs and Name of Nearest Lehigh Representative



COMBINATION VALVES Panel units, hand and foot operated valves. Wide range of models.

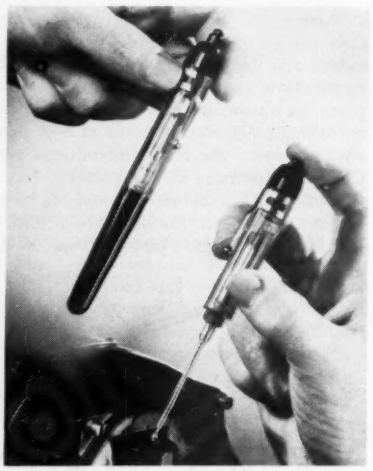
Lehigh Minor AIR VALVES and CYLINDERS

Low priced, light duty. For air operated jigs, fixtures, high speed operations.

Lehigh INC.

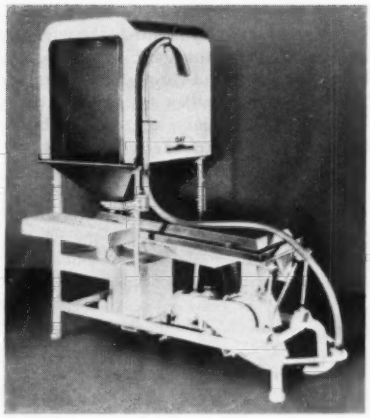
ENGINEERS & MANUFACTURERS
1513 Lehigh Drive
EASTON, PENNA.

Circle 19A on reply card



ON HAND WHEN NEEDED

Just unscrew the barrel, press the button on top, and this pocket-size oiler is ready for service, like a fountain pen. The oil tube is transparent and, together with the barrel and other parts, is molded of Tenite, a tough butyrate plastic. Called Oil-Mate, it is made by E.S. Tubin Engineering Company, Burbank, Calif., and is said to be leakproof.



flour into a low-pressure air system while the tailings drop into a removable compartment. Air at from 4 to 12 psi pressure is used and is sufficient to elevate the flour 8 feet after a 25-foot horizontal run or 20 feet after a 4-foot run. Depending on the lift it takes approximately 10 cfm to convey 100 pounds of material a minute. The air may be supplied either by existing lines or a separate compressor. In the latter case a receiver pressure of 40 psi is recommended. The Airmatic may be equipped with casters for operational flexibility or installed permanently. If stationary, 2- or 3-way diverting valves may be attached to the discharge tube to deliver different flours to a battery of dough mixers. By-pass valves are provided to permit purging or cleaning the entire system at full pressure.

Circle 12E on reply card

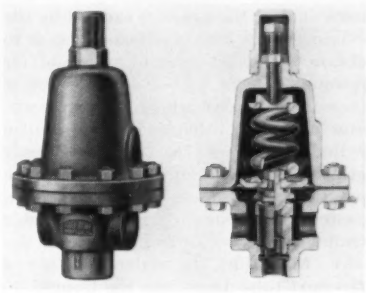
Safety of fuel and lubricating systems may be increased as the result of a platen gasket designed by the Aviation Products Division of Goodyear Tire & Rubber Company specifically for use on aircraft. In that field it has reportedly proved its effectiveness under such severe conditions as repetitious cycles of fuel wetting and drying out, vibration, pressure and atmospheric variations and extreme temperature changes. The company is planning to market the gasket also for military and commercial fuel and lubricating systems.

Circle 13E on reply card

Through the development of a machine that makes it possible to pack cartridges of small diameter, Hercules Powder Company is now making King-Size dynamite cartridges that are said to effect substantial savings in time and labor in loading deep blastholes in mining and quarrying operations and on construction jobs. They are available in diameters of 1¼, 1½, 1¾ and 2 inches and in 24-, 20-, 16- and 12-inch lengths. The conventional 8-inch cartridge will continue to be available.

Circle 14E on reply card

What is described as a completely new series of back-pressure relief valves has been announced by A. W. Cash Valve Mfg. Corporation. The feature of the device is a floating ring which is free to move laterally in any direction to find its own alignment with a spherical seat disk and which is said to insure unusual sensitivity, high capacity, good closure and well-nigh frictionless operation. A spring above a diaphragm holds the valve closed; inlet-fluid pressure below the diaphragm is the opposing force. When the latter overbalances the spring load the valve opens, relieving the excess pressure and restoring the upstream pressure, as desired. The Type FR, as it is designated, is adjustable and has two side inlet connections permitting installation for straight-through service or, with one connection plugged, in angle fashion. It is available in pipe sizes from



½ inch to 2 inches for pressures up to 400 psi and in varying metals for use with virtually all gases and fluids, even "Bunker C" oil. It is not recommended for steam service.

Circle 15E on reply card

By means of a new hot spinning machine all the operator has to do is stack

"No gas or oil. Just check my tires and inflate my seat cushion."

WISCONSIN-POWERED "In-Plant" Fire Truck Proves its "Put-Out Power"

Designed primarily for "in-plant" factory and warehouse fire protection, this versatile, highly maneuverable, fully equipped Kalamazoo Fire Truck, made by Kalamazoo Mfg. Co., Kalamazoo, Mich., demonstrates its efficiency in extinguishing an "out-plant" oil and high octane fire.

Extremely compact design enables this fire truck to negotiate standard doors, factory and warehouse aisles, moving at speeds up to 15 miles per hour.

Recognizing the fact that vital emergency service requires the utmost dependability from the power unit, the builders stake their reputation on the quick-starting ability, fast get-away and operating efficiency of the Wisconsin Model TF 2-cylinder Heavy-Duty Air-Cooled Engine.

You can't do better than specify "Wisconsin Power" for *your* equipment, whatever its nature. Available in a complete power range from 3 to 36 hp. Write for descriptive Bulletin S-164.

WISCONSIN MOTOR CORPORATION
World's Largest Builders of Heavy-Duty Air-Cooled Engines
MILWAUKEE 46, WISCONSIN

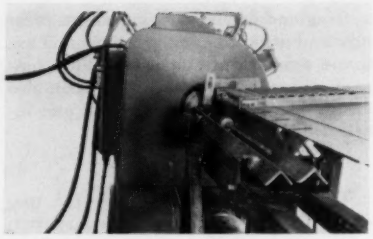
Circle 20A on reply card

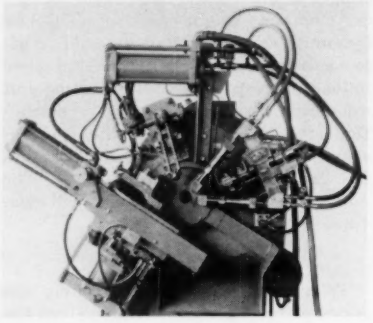
lengths of tubing in an inclined rack and remove the finished product, the unit itself automatically feeds each tube, heats it, spins and welds the end to close and seal it and ejects the work. All this is done in a matter of seconds, it is claimed.

From the rack at the rear the stock rolls into a V-shaped trough from which it is pushed through a spindle by a pneumatic cylinder. When the piston reaches the end of its stroke a stop swings down and spots the tube by slightly forcing it back against the pressure exerted by the cylinder. The stop is adjustable so as to obtain the exact amount of metal for spinning. As it moves into position it trips a pilot valve which, in turn, actuates a master valve and collet control cylinder. As soon as the collet firmly grips the stock the stop swings out of the way and in so doing operates a microswitch, thus energizing an adjustable timing relay that turns on a heating device. Meantime, the feeder retracts and the next tube drops into the trough.

When the tube has reached the proper temperature either by oxyacetylene or induction heating, the relay turns off the heat and simultaneously actuates a solenoid valve that causes another pneumatic cylinder to push a cross slide up to a stop set so that the spinning tool just comes in contact with the work. As pressure builds up in the cross-slide cylinder a sequence valve opens and allows air to enter an air-hydraulic cylinder that both operates the spinning head and controls the speed of the tool which forms the rounded end and seals it by welding. When spinning is completed, the cycle is reversed and the finished piece is ejected by the next tube fed through the spindle. The machine handles tubing up to 3 inches, outside diameter, and is built by Modern Machine Tool Company.

Circle 16E on reply card





REAR AND FRONT VIEWS

The picture at the bottom shows the air-cylinder (lower-left) that pushes the cross slide and the air-hydraulic cylinder that controls the spinning head.

By a new method of "mothballing," machinery temporarily out of use can be protected against corrosion at one-tenth the former cost, according to *American Machinist*. It consists of covering the equipment with glass cloth to which asphalt is applied by spraying. The resultant shroud is tough but sufficiently friable so that it can be easily shattered.

Disposable cloth pads impregnated with an active nontoxic germicide have been put on the market to prevent the spread of colds by telephones. Called tel-O-cide, they are packed 100 in a jar and are said to sanitize and deodorize mouthpiece and receiver in a few seconds after wiping. They are made by General Scientific Equipment Company.

Circle 17E on reply card

Standard metric-thread taps are being produced in all sizes and pitches for the first time in the United States as a stock item by Shearcut Tool Company. This news should be of interest to factories using modern imported machine tools

Sauerman installations provide economical handling of a wide variety of bulk materials, from bauxite to zinc ore . . . at rates ranging from 10 to 800 cu. yds. per hr. Storage areas range from a small bin to ten acres or more.

Quick change from stockpiling to reclaiming is accomplished by unclamping and re-attaching the operating cables so as to turn the bucket around when the power is applied. Non-caving or free-flowing materials are handled with equal efficiency.

The operator can be located in a safe cab overlooking the work area. Many Sauerman installations are remotely operated through air or hydraulic controls.

Let Sauerman engineers show you how to use your storage area to its fullest extent. Send for Catalog E, *Bulk Storage by Power Scraper* and 32 *Tested Methods For Handling Bulk Materials*. Request the following Field Reports:

FR-224 Handling Ore with Drag Scrapers
FR-227 Storage and Handling—Potash

SAUERMAN BROS. INC.

648 S. 28th AVE. BELLWOOD, ILL.

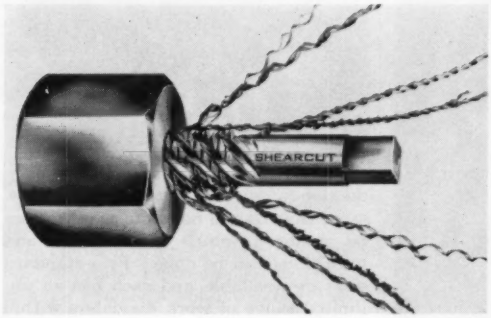
Circle 21A on reply card

FOR INDUSTRIAL HOT JOBS

This garment is made from a new flexible material—asbestos cloth coated with a thin film of aluminum—that is said to reflect rather than insulate against radiant heat and to weigh half as much as the protective fabrics in common use. Reports on field tests indicate that the clothing gives wearers more freedom of movement, does not collect splatter because it rolls off and allows men to work in close proximity to intense heat for longer periods of time. The aluminized asbestos is a product of Minnesota Mining & Milling Company.

Circle 18E on reply card

and to owners of foreign automobiles who have always been at a disadvantage because taps necessary to replace any of their metric-threaded screws, nuts and bolts usually had to be made to order. Manufactured of the finest high-speed steel and ground from a solid piece after



hardening, they are based on a design originated by the company several years ago. The taps have high spiral flutes and cutting edges which, with low torque requirements, are said to give them a long useful life and to cut production costs.

Circle 19E on reply card

Mine operators have discovered that Punch-Lok Clamps, used primarily in connection with hose lines, expedite the job of suspending heavy armored electrical cables in vertical shafts. Of the open-end type, the clamps are slipped around the 3-inch cable and wooden support at 3-foot intervals and are tensioned and locked without screws or other fasteners by a special tool. Once in place they remain tight, but they can be removed without difficulty if the cable has to be shifted.

Circle 20E on reply card

Clerks who have to use rubber stamps generally spend a lot of time looking for the one they need. To avoid this, and to prevent cluttering desks with them, Douglas M. Homs & Company is making two that do the work of 25. One combines a 12-year dater (1954-65) with twelve common commercial words such as paid, received, billed, charged and delivered, while the other covers twelve expressions including first-class mail, special delivery, parcel post and for deposit only. The words or phrases are clicked into position by twisting a key and the dates are set by band turning wheels.

Circle 21E on reply card

A new thread-rolling attachment manufactured by The Sheffield Corporation requires only one adjustment for precision matching of rolls and two adjustments to set the pitch diameter with accuracy. Called the Precision-Rol, it rolls close-tolerance uniform threads, right- or left-hand, on automatic screw machines or turret lathes at mass-pro-

"Those other fellows are just seismograph, gravitometer and magnetometer experts. This is the one that really finds the oil."

COMPRESSED

in one handy volume . . .

the up-to-date facts
you need to solve
turbomachine problems . . .

TURBOBLOWERS

Theory, Design and Application of Centrifugal and Axial Flow Compressors and Fans

By A. J. STEPANOFF,
Ingersoll-Rand Co.

This useful new book gives you proven methods of attack on turbomachine problems and shows how turboblowers are built in the U. S. and abroad. It covers all the developments in the field for the last 15 years, discussing type, size, and field of application for modern turboblower design. The author explores a number of new techniques—all useful in modern practice. These include a compressor impeller based on a single pattern of flow; pressure generated hydrodynamically; water-cooled compressors, etc.

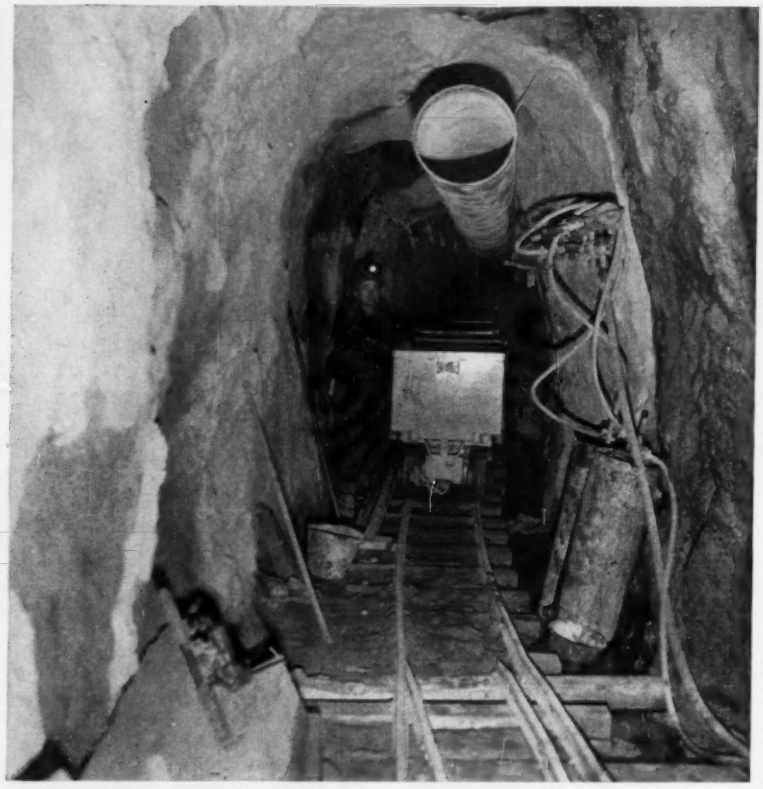
Also given are ways for improving the performance of fans—at little or no increase in costs. In addition, the features of each class of gas compressors are discussed to enable you to select and care for gas pumping machines. If you're looking for the latest information on how, why, and where turbomachines work, order this book today from

COMPRESSED AIR MAGAZINE

942 Memorial Parkway
Phillipsburg, New Jersey

1955. 377 pages. $8.00.

UNDERGROUND "OXYGEN TENT"



This 16-inch fan line of Naylor lightweight pipe brings clean, fresh air to diggings 3000 feet from the mine portal.

Naylor's exclusive lockseamed, spiralwelded structure makes it the perfect vehicle for push-pull ventilating jobs. It's light in weight, easy to handle and install—particularly with the Naylor one-piece Wedge-Lock coupling to speed connection. The spiral truss adds extra collapse strength and safety, permitting the use of lighter gauge steel without sacrificing strength.

For full details, write for Bulletin No. 507 on line pipe and Bulletin No. 514 on vent pipe couplings.

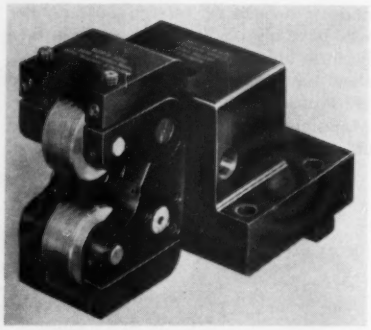
NAYLOR PIPE

NAYLOR PIPE COMPANY

1245 East 92nd Street, Chicago 19, Illinois

Eastern U. S. and Foreign Sales Office: 350 Madison Avenue, New York 17, New York

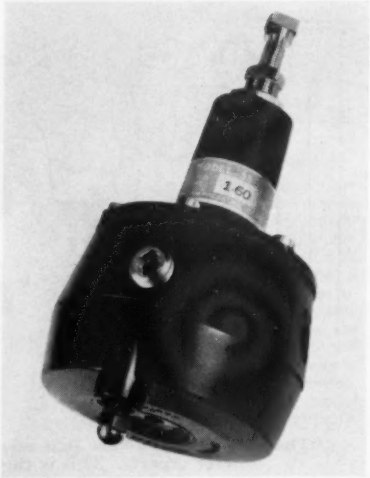
Circle 22A on reply card



duction rates. Annular or helical grooves, taper threads and nonuniform starts can be produced, knurls can be made and burnishing can be done. Five standard sizes are available, and each has an unlimited range of work diameters within its capacity. All gearing is totally enclosed, and rolls can be timed and adjusted without removing the unit from the machine.

Circle 22E on reply card

For the purpose of supplying clean, dry air for instrument and equipment control, Kendall Controls Corporation, 144 Moody Street, Waltham, Mass., has introduced an adjustable output regulator and moisture separator designated as the Model 55. The unit has a resinous bonded filter element, a drip well drained by a push-button valve and an automatic relief that becomes active when the pressure exceeds the preset value. It is designed for a maximum inlet pressure of 150 psi and has a flow capacity up to 15 cfm. The regulator is 3⅜ inches in diameter and 7⅛ inches high with the adjusting screw fully extended and may be panel, bracket or line mounted. The company will send a Model 55 for trial use without charge to equipment manufacturers only. Requests should be written on letterheads and operating pressure range should be specified.



QUOTES

—FROM HERE AND THERE

Revibration Good for Concrete

"The strength of any concrete can be improved by revibration.

"Many contractors and engineers stare incredulously when this statement is made. The very idea of disturbing early hardening processes, breaking initial bond or interfering with crystallization of cement is completely foreign to them. But twelve years experience have broken down any inhibitions of the writer about tampering with green concrete. The benefits are multiple:

"In addition to strengthening the concrete, revibration makes denser concrete; produces tenacious bond; removes air-and-water pockets; prevents honeycomb; releases water trapped beneath horizontal reinforcing bars; reduces or eliminates surface irregularities.

"Revibration is effective both in ordinary concretes and in concretes doctored with additives. . . .

"Experiments seem to indicate that revibration is effective as long as it is physically possible to insert the vibrator spud into the concrete. This is about twice the time of initial set. The experiments show, however, that concrete revibrated at about the time of initial set yields a significant gain in 28-day compressive strength, when compared with concrete either unrevibrated or revibrated substantially before or after the time of initial set. For Type I cement without admixture initial set time is about 2½ hours under normal temperature conditions."

Cornelius R. Barrett, Engineering News-Record, March 10

Safety Precautions for Skin Divers

"Man is an adventuresome creature. He devised the airplane, and flies around with the birds. He wants to frolic with fishes, and now he has the aqua lung and other forms of underwater breathing apparatus. . . . So popular has this new sport become, there are many underwater swimming and spear fishing clubs.

"Because the apparatus . . . is simple to use, persons with little or no training are likely to use it and some of them get into serious predicaments. The amateur underwater enthusiast usually has little idea of the limitations of his apparatus, of safety measures to be carried out, or how to meet emergencies. . . .These include the necessity to clear the mask of water and to replace the mouthpiece if it is lost.

"There are emergencies when it is vital to know the method whereby two men can breathe from one apparatus. There will be cases when people will dive and

CARBON-BAKELITE PISTON RINGS

METALLIC PACKINGS

POWER PISTON RINGS

BAKELITE VALVE DISCS

57 YEARS OF PROGRESS

and

we're still growing!

Original equipment for engine builders or replacement packing piston rings or valve discs for the gas, oil and chemical industries — all are expanding lines in our production 'family tree.'

FRANCE offers you not only the finest engineering and consistent quality in these products, but also the SERVICE demanded by industry.

Get the facts and get SERVICE . . . from FRANCE.

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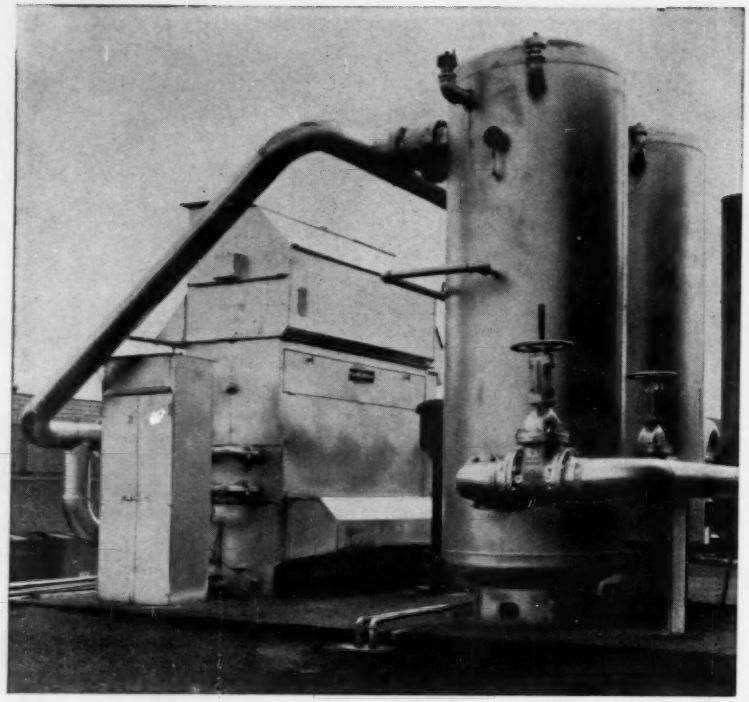
Circle 23A on reply card



HOW YOU SAVE,
Getting Drier Compressed Air

● Direct saving in the cost of cooling water saves the price of the Niagara Aero After Cooler (for compressed air or gas) in less than two years.

Extra, for no cost, the drier air gives you a better operation and lower costs in the use of all air-operated tools and machines, paint spraying, sand blasting or moisture-free air cleaning. Water saving also means less expense for piping, pumping, water treatment and water disposal, or you get the use of water elsewhere in your plant where it may be badly needed.

Niagara Aero After Cooler assures all these benefits because it cools compressed air or gas below the temperature of the surrounding atmosphere; there can be no further condensation in your air lines. It condenses the moisture by passing the air thru a coil on the surface of which water is evaporated, transferring the heat to the atmosphere. It is installed outdoors, protected from freezing in winter by the Niagara Balanced Wet Bulb Control.

Write for complete information; ask for Bulletin No. 98

NIAGARA BLOWER COMPANY

Dept. CA 405 Lexington Ave. New York 17, N. Y.

Niagara District Engineers in Principal Cities of U. S. and Canada

INDUSTRIAL COOLING HEATING • DRYING

NIAGARA

HUMIDIFYING • AIR ENGINEERING EQUIPMENT

Circle 24A on reply card

develop bends, air embolism, spontaneous pneumothorax squeeze, and nitrogen narcosis—all medical terms associated with accidents related to the physical properties of gases and water and their effect on the human body.

"Air supplied to a person underwater must be under a pressure equal or nearly equal to that exerted by the water on his body, and the deeper one goes the more air pressure is required to equalize the water pressure and allow unhampered breathing.

"Skin diving and aqua lung diving offer exhilarating sport, if done with safety. We are waiting for that song 'Oh, meet me on the deck of that old sunken wreck!' "

Pennsylvania Medical Society and Northampton Medical Society

Airleg Drill Popular in Metal Mines

"The light-weight airleg drill is well on its way to becoming the most popular drilling combination underground (metal mining). Originally used only in hard-to-work places, its use has spread to development work and drifting. In some cases the airleg has replaced the diamond drill in exploration and sampling work. The expanding use of the airleg has been aided to a great degree by the improved models offered by drill manufacturers. Better balance and convenient grouping of controls facilitate operation and gain better miner acceptance."

Prof. Stefan Boshkov, School of Mines Columbia University, in Mining Congress Journal, February 1955

Books and Industrial Literature

The art of excavating earth and rock has undergone great transformation in the past quarter-century. The tempo of operations has quickened, and the methods and equipment involved have changed radically. Machines are more numerous, more ingenious, more powerful and more efficient. The changes have come so fast that the literature on the subject has failed to keep abreast of them and there has been no good source of reference other than the trade press. That void has now been capably filled by Herbert L. Nichols, Jr., a member of the contracting fraternity with a background of practical experience.

Mr. Nichols's *Moving the Earth* is the first book of consequence dealing with the tools and techniques of excavation to appear within 25 years. Moreover, it is by far the most complete work on the subject ever produced. Its 1280 pages contain 400,000 words and 1266 illustrations, with 27 pages of glossary and 43 of index, all encased in a 2½-inch-thick volume bound in durable Fabrikoid.

It would be unjust, however, to judge this book by its physical proportions alone. Despite its size, it contains no irrelevant material and few wasted words. The simple, nontechnical language, short sentences, legible type and good printing combine to make for easy understanding and untiring reading.

The 21 chapters include just about everything anyone might want to know about every phase of the highly ramified field of dislodging and moving earth and rock. The chapter on compressors and drills, for example, runs to 78 pages and is typical of the comprehensiveness of the entire work.

The volume is intended primarily to answer the countless questions and solve the never-ending problems that constantly confront small contractors and their foremen and machine operators. In doing this it serves equally well not only big contracting firms but also architects and students, because even the biggest jobs are merely a lot of little ones put together. Even property owners and home builders have been considered, and they, as well as public officials, will find the book valuable for planning and supervising all earth-moving jobs.

Mr. Nichols's career in construction began when he was graduated from Columbia University in 1929. From 1934 to 1941 and from 1945 to the present he has operated an excavation and grading business in Connecticut. From 1941 to 1945 he worked first as a civilian employe of the Army in South America and the West Indies and then as a member of the Seabees assigned to road construction in the Aleutian Islands.

He is not a newcomer to the writing field. With his wife, Dr. Hazel J. Berglund, he produced a controversial medical book, *It's Not All in Your Mind* a few years ago. Then, in March 1954, he published *How to Operate Excavation Equipment*, which is now in its fourth printing.

Moving the Earth is published by North Castle Books, 212 Bedford Road, R.D. 3, Greenwich, Conn. Price, $15.00.

Ten years of research aimed primarily towards the development of "supersonic" and high-performance materials is surveyed in an Air Force publication recently made available to industry by the U. S. Department of Commerce. It contains abstracts of Wright Air Development Center reports from July 1, 1951, to June 30, 1953, in the fields of metallurgy, textiles, petroleum products, structural materials, rubbers, plastics, packaging, protective treatments and analysis and measurements. Previous papers are listed by title, investigator and date. *A Review of the Air Force Materials Research and Development Program*, PB 111537, is published by the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. Price, $3.75.

Airmatic Valve, Inc., offers a 66-page catalogue illustrating its line of 2-, 3- and 4-way air-control valves for high- and low-pressure installations.

Circle 23E on reply card

In a concise but complete report, National Forge & Ordnance Company gives the story of steel forgings for industry from electric steelmaking to finished machining.

Circle 24E on reply card

See-Thru Cabinets for storing all kinds of small parts are shown in a catalogue released by General Industrial Company, supplier of materials-handling equipment.

Circle 25E on reply card

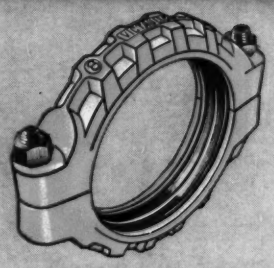
Air Reduction Sales Company is distributing a 24-page brazing manual that deals fully with methods of joining metals with its Aircosil silver alloys and fluxes and Airco gas atmospheres.

Circle 26E on reply card

Production men should be interested in a new Ingersoll-Rand catalogue which is devoted mainly to the problem of running on nuts, bolts, cap screws and other types of fasteners and to its complete line of air

VICTAULIC

METHOD OF PIPING



VICTAULIC COUPLINGS

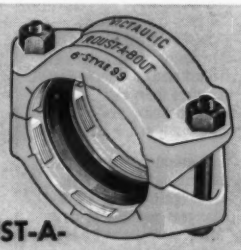
Styles 77, 77-D for standard applications. Simple, fast to install—sturdy and reliable. Sizes ¾" to 30". Style 75 Light-Weight Couplings for light duty applications. Sizes 2", 3", 4". Additional styles for cast iron, plastic and other pipes. Sizes through 60".

VICTAULIC FULL-FLOW FITTINGS

Complete line of Elbows, Tees, Reducers, Laterals, etc.—to fit all Victaulic Couplings. Streamlined for top efficiency, easy to install. Sizes ¾" to 12".

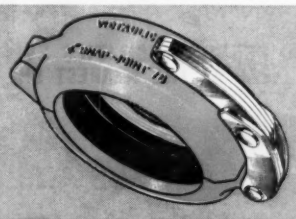
VIC-GROOVER TOOLS

Handy, on-the-job grooving tools that do the work in half the time. Light weight, easy to handle—operate manually or from any power drive. Automatic groove position and depth. Sizes ¾" to 8".



ROUST-A-BOUT COUPLINGS

Style 99 for plain or beveled end pipe. Best engineered, most useful plain end joint on the market. Simple, husky — easy and fast to install. Takes strong bull-dog grip on pipe. Sizes 2" to 8".



VICTAULIC SNAP-JOINTS

Victaulic's new boltless, speed coupling. — Style 78 — hinged into one assembly. Hand-locks for time and dollar savings. Sizes 1", 1¼", 2", 3", 4".

EASIEST WAY TO MAKE ENDS MEET

Promptly available from distributor stocks coast-to-coast. Write for NEW Victaulic Catalog-Manual 55-3B

VICTAULIC COMPANY OF AMERICA

P. O. Box 509 • Elizabeth, N. J.

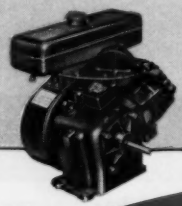
Circle 25A on reply card

Ingersoll-Rand GYRO-FLO 105 Compressor supplying air for paving breaker cutting off concrete piling to set bridge. Power, Continental Red Seal.

means Dependable Power

In addition to its large engines, Continental builds an outstanding line of heavy-duty air-cooled four-cycle models for industrial applications requiring 2 to 3 h.p. (AU series illustrated). Advanced engineering gives them easy starting, high dependability, and unusual lugging capacity at low speeds . . .

Options: patented and exclusive Contex® external ignition system, low-level ignition cut-off, 6-1 reduction gear, and other features. Available also for use on kerosene . . . For information on these models, address Air-Cooled Industrial Engine Division, 12800 Kercheval Ave., Detroit 15, Mich.



All through the construction industry, you find Continental Red Seal engines accomplishing two important things. One is furnishing power to do the world's work; the other, building prestige for specific makes of equipment. The Red Seal line includes models engineered to a wide range of building applications, and meeting those needs completely . . . turning more and more users of mixers, pumps, compressors and other specialized machinery to makes which feature this extra-dependable power.

•

PARTS AND SERVICE FACILITIES EVERYWHERE . . . NEAR AS THE NEAREST PHONE

Continental Motors Corporation

MUSKEGON • MICHIGAN

6 EAST 45TH ST., NEW YORK 17, NEW YORK • 3817 S. SANTA FE AVE., LOS ANGELES 58, CALIF.
6218 CEDAR SPRINGS ROAD, DALLAS 9, TEXAS • 910 S. BOSTON ST., ROOM 1008, TULSA, OKLA.
1252 OAKLEIGH DRIVE, EAST POINT (ATLANTA) GA.

Circle 26A on reply card

Impactools designed for the purpose. For easy reference, each size is described on a 2-page spread, which also gives specifications, equipment furnished with each tool, case histories, and on-the-job pictures. Of 52 pages, the publication (Form 5200-A) lists the numerous accessories available for Impactools and contains a section dealing with the company's Universal Electric Impactools and other products.

Circle 27E on reply card

The DoAll Company has released a brochure on its molybdenum, tungsten and cobalt high-speed-steel bits, finished ground or unground. Data includes suggestions as to proper grinding and mounting of the bits.

Circle 28E on reply card

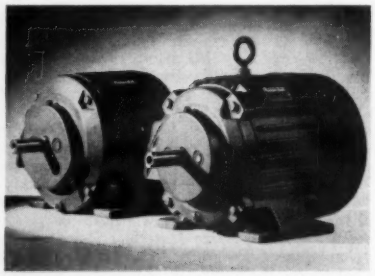
Minneapolis-Honeywell Regulator Company's Bulletin 1161 discusses the basic principles of liquid level measurement, control and transmission, together with the systems, their limitations and advantages.

Circle 29E on reply card

In Bulletin S-3-55 the Watson-Stillman Fittings Division of H. K. Porter Company describes its new 150-pound stainless-steel pipe fittings designed for standard pressure services calling for heat and corrosion resistance and toughness at low temperatures.

Circle 30E on reply card

Check the Facts is the title of a 12-page illustrated booklet on a new line of totally enclosed and protected a-c motors announced by Reliance Electric & Engineering Company. In addition to information common to all Reliance motors, it lists many



characteristics of the latest design, which includes fan-cooled, corrosion-proof and explosion-proof types. Engineers and designers will find in the publication all the data they should have in choosing a motor for a specific purpose. The illustration shows a protected motor (left) and an enclosed fan-cooled motor.

Circle 31E on reply card

Aftercoolers and separators for compressed-air systems are discussed in Bulletin No. 711 published by R. P. Adams Company, Inc. It deals with the subject on a dollar-and-cents basis, shows cutaway and installation views and contains a chart giving the moisture content of air under pressure at various temperatures.

Circle 32E on reply card

National Machine Products Company has issued a 24-page Engineering Data Section for its catalogue on standard and special hexagon nuts. It deals with such subjects as fastener design, installation techniques and applications and enters into the variables that must be considered in the matter of bolt tightness and wrench torque.

Circle 33E on reply card

General Electric Company's 1955 edition of the Instrument Transformer Buyer's Guide, GEC-1028, is ready for distribution.

The 100-page publication contains ratings, ASA accuracy classifications and prices on all its standard indoor and outdoor potential and current transformers and includes listings of ratio and phase-angle tests, tables of replacement types and mechanical and thermal data.

Circle 34E on reply card

A condensed catalogue illustrating and describing its four basic types of power trucks, as well as others built for special industrial services, has been issued by The Elwell-Parker Electric Company. Also included are pictures and information on more than a dozen attachments that increase the flexibility of the vehicles.

Circle 35E on reply card

A 12-page catalogue dealing with Snyder automation machines, special machine tools and mill-balancing machines may be obtained from Snyder Tool & Engineering Company. The brochure shows how five basic standard components can be utilized to make up special automation machines and describes Snyder's design and manufacturing facilities.

Circle 36E on reply card

Black, Sivalls & Bryson, Inc., has published a manual which describes a new method developed by it for sizing control valves for liquid, steam and gas applications. It involves the use of two "tools" based on thousands of flow tests: a Size-O-Graph, which determines what a valve must do, and CV Ratings which determine what it will do.

Circle 37E on reply card

Marinite, a structurally strong, fireproof building and insulating sheet material is dealt with in a 16-page booklet announced by Johns-Manville. In addition to listing its physical and thermal properties, the brochure gives helpful suggestions as to the handling, construction and fabrication of the material, which is being used to build driers, ovens, breechings and housings.

Circle 38E on reply card

The Fairbanks Company has compiled a new valve-comparison manual that supersedes the one dated December 1951. In the latest edition, the tables are arranged alphabetically by manufacturers with the valves listed numerically and enable users to compare Fairbanks' complete line of bronze and iron-body valves as to similarity in design, construction and pressure rating with those of other leading manufacturers.

Circle 39E on reply card

A guide to the selection and application of its tubing has been published by Superior Tube Company. Designated as Bulletin 40, it groups the 46 principal analyses of Superior tubing into five classifications: stainless steel, nickel and nickel alloys, carbon and alloy steels, beryllium copper and titanium. A short summary of the principal properties of each and its normal production limits are given, as well as information on glass-to-metal seals in electronic and electrical manufacturing industries.

Circle 40E on reply card

The latest prepolishing and finishing methods with coated abrasives are shown in a 27-minute film made by Norton Company, an authority in this field. Entitled *Coated Abrasives Belts Speed Metalworking Production*, the 16-mm sound and color movie will be loaned without cost to foremen groups, plant production training classes, trade schools, technical societies and engineering colleges upon application to Department FI, Behr-Manning Division, Norton Company, Troy, N. Y.

ASK THE MAINTENANCE MAN

there is a difference in pipe tools!

Good pipe tools mean longer service life and greater satisfaction on every job. Toledo unconditionally guarantees every pipe wrench it makes . . . your assurance of maximum service at lowest cost. Single spring action gives quicker, easier setting on pipe surfaces. Replaceable jaws in every size from 6″ to 48″. Your supplier knows and stocks Toledo pipe wrenches, pipe cutters, pipe threaders and power machines. Next time try Toledo.

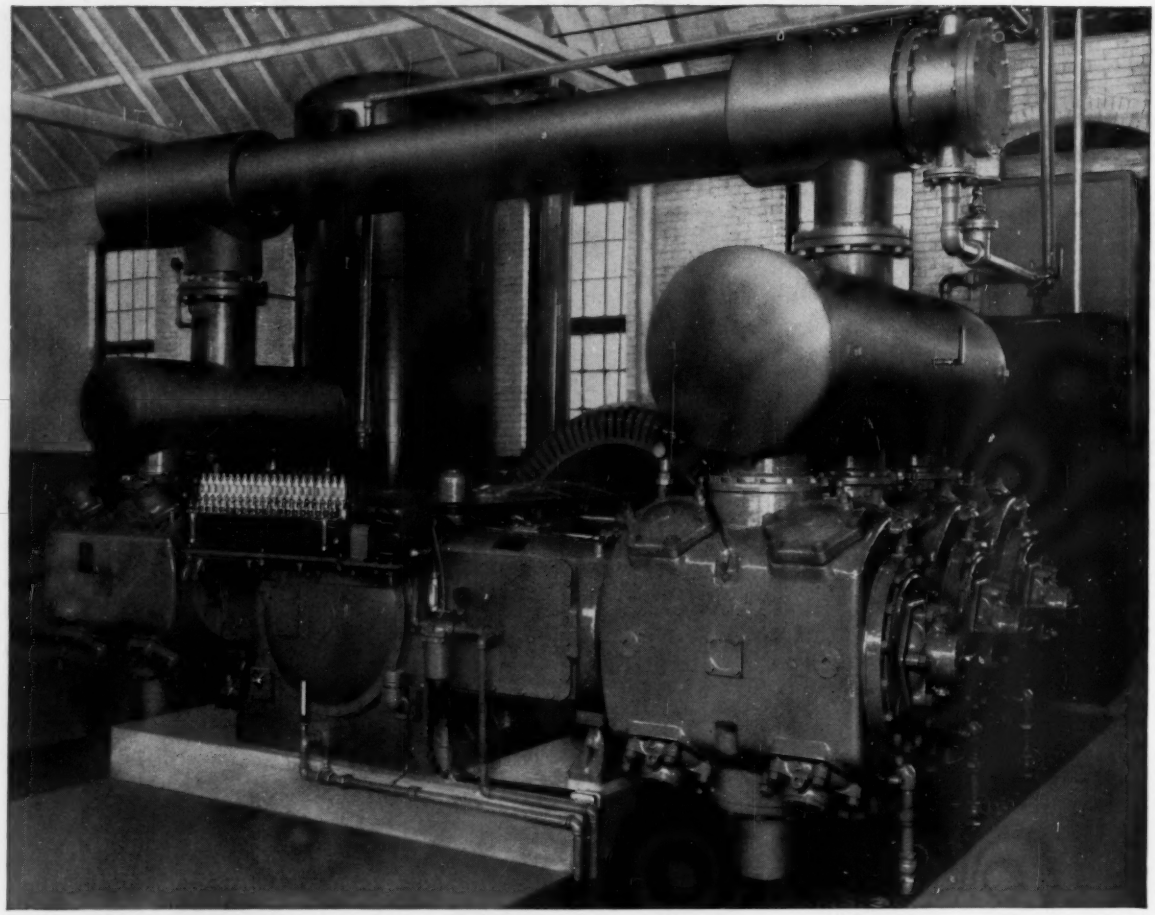
THE TOLEDO PIPE THREADING MACHINE CO.
TOLEDO 4, OHIO

BUILDERS OF THE WORLD'S FINEST PIPE TOOLS

TOLEDO

PIPE THREADERS • PIPE WRENCHES • PIPE MACHINES

Circle 27A on reply card



ROSS INTERCOOLER AND AFTERCOOLER

teamed with 800 HP compressor to deliver air clean and dry

Delivering industrial air in a well-known electric range manufacturing plant, this 800 hp motor-driven compressor is equipped with a Ross Intercooler and a Ross Aftercooler.

Clean, dry compressed air is thus assured . . . at all times!

Rated first for heat exchange efficiency by compressor builders and users alike, Ross Cylinder-Mounted-Intercoolers, Aftercoolers, Lube Oil Coolers and Jacket Water Coolers are ruggedly constructed for long, economical service. Available in a wide range of standardized designs, they can be delivered promptly to meet most needs.

To see how Ross Exchangers can be used to meet *your* needs profitably, merely furnish a brief description of your compressors and their applications. Detailed literature will be mailed to you promptly, without obligation.

KEWANEE-ROSS CORPORATION
DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION
1471 WEST AVENUE • BUFFALO 13, N. Y.
In Canada: Kewanee-Ross of Canada Limited, Toronto 5, Ont.

AFTERCOOLERS
INTERCOOLERS
LUBE OIL COOLERS
JACKET WATER COOLERS

Circle 28A on reply card

It's tire-tough, because it's built the way a tire is—with *an exclusive hose construction no other maker matches.*

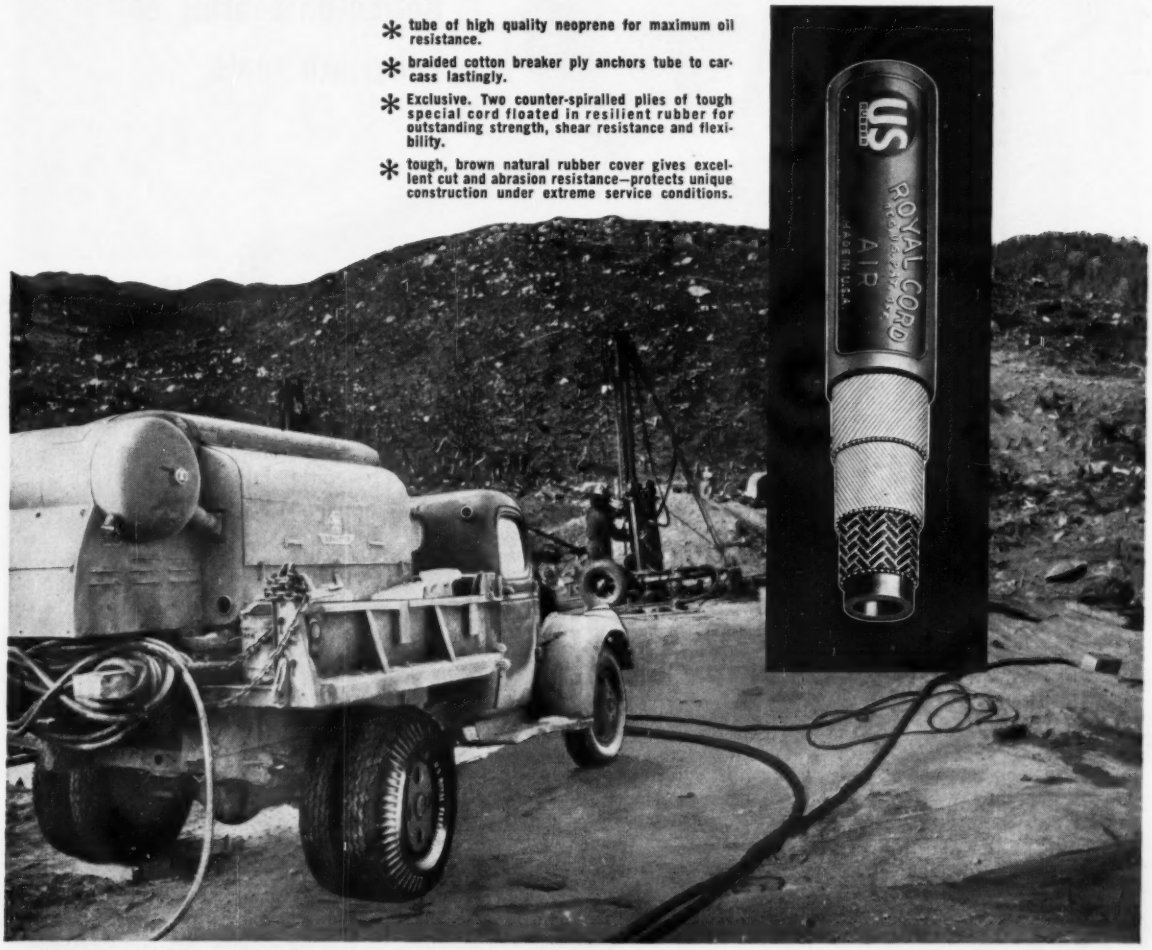
Proved in mines and quarries everywhere, U. S. Royal Cord Hose offers extremely high hydrostatic value, with a minimum of contraction and elongation. And with its great flexibility, shear resistance and toughness, it can be run over repeatedly by heavy equipment without harm.

Recommended particularly for applications where shock and excessive pressures are met, U. S. Royal Cord is available in continuous lengths from any of our 27 District Sales Offices, or by writing to the address below. *Whatever* your hose requirement, you'll find it pays to turn to "U. S." There's a job-engineered U. S. Hose for practically every purpose—an expert staff of "U.S." engineers to assist you in your hose selection.

This hose took a tip from a tire!

U. S. Royal Cord Air Hose

- tube of high quality neoprene for maximum oil resistance.
- braided cotton breaker ply anchors tube to carcass lastingly.
- Exclusive. Two counter-spiralled plies of tough special cord floated in resilient rubber for outstanding strength, shear resistance and flexibility.
- tough, brown natural rubber cover gives excellent cut and abrasion resistance—protects unique construction under extreme service conditions.



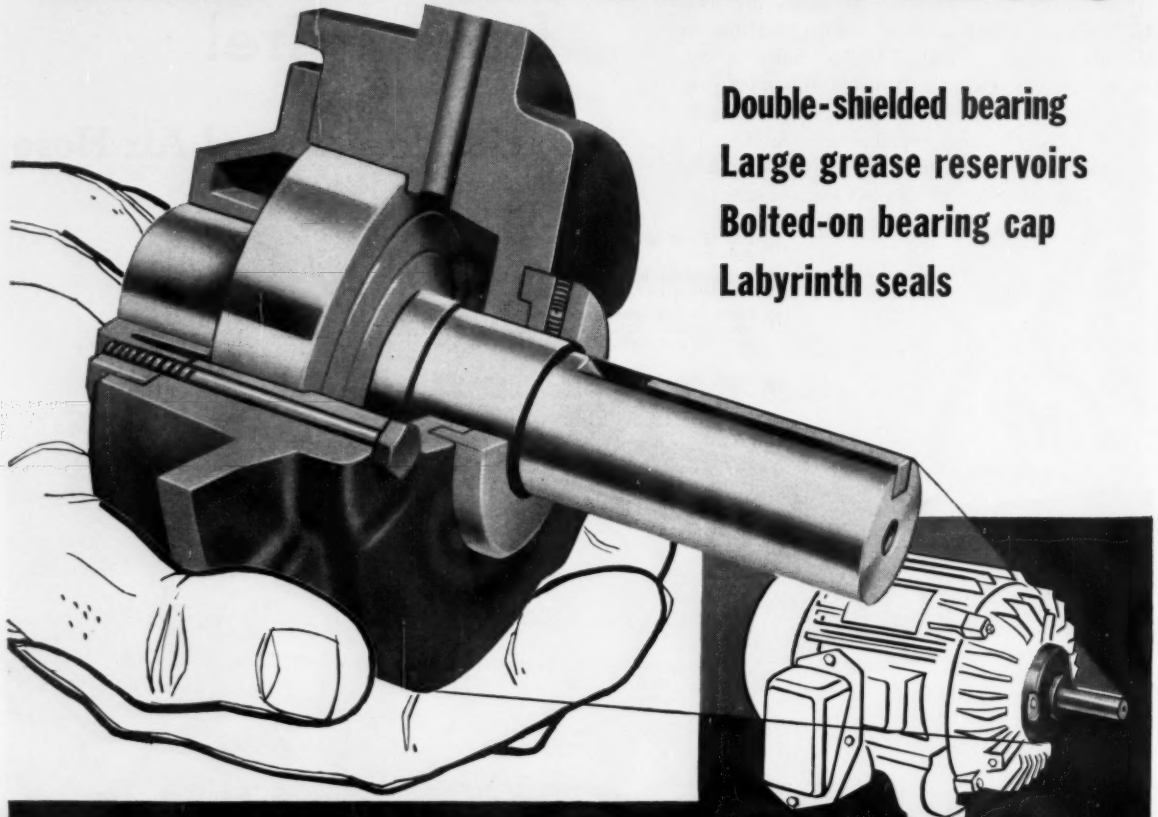
"U.S." Research perfects it..."U.S." Production builds it... U.S. Industry depends on it.

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION · ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Hose • Belting • Expansion Joints • Rubber-to-metal Products • Oil Field Specialties • Plastic Pipe and Fittings • Grinding Wheels • Packings • Tapes Molded and Extruded Rubber and Plastic Products • Protective Linings and Coatings • Conductive Rubber • Adhesives • Roll Coverings • Mats and Matting

Here Is Extra Motor Value



Double-shielded bearing
Large grease reservoirs
Bolted-on bearing cap
Labyrinth seals

This Allis-Chalmers Bearing Design Gives More for Your Motor Dollar

The bearing cap is held tightly in place against the inner face of the bearing enclosure. This cap, with its close running clearances, keeps grease from the interior of the motor . . . retains an ample supply within the bearing enclosure.

At the outer side of the bearing, double labyrinth seals keep grease in, also keep dirt out. What's more, large grease reservoirs act as additional dirt traps.

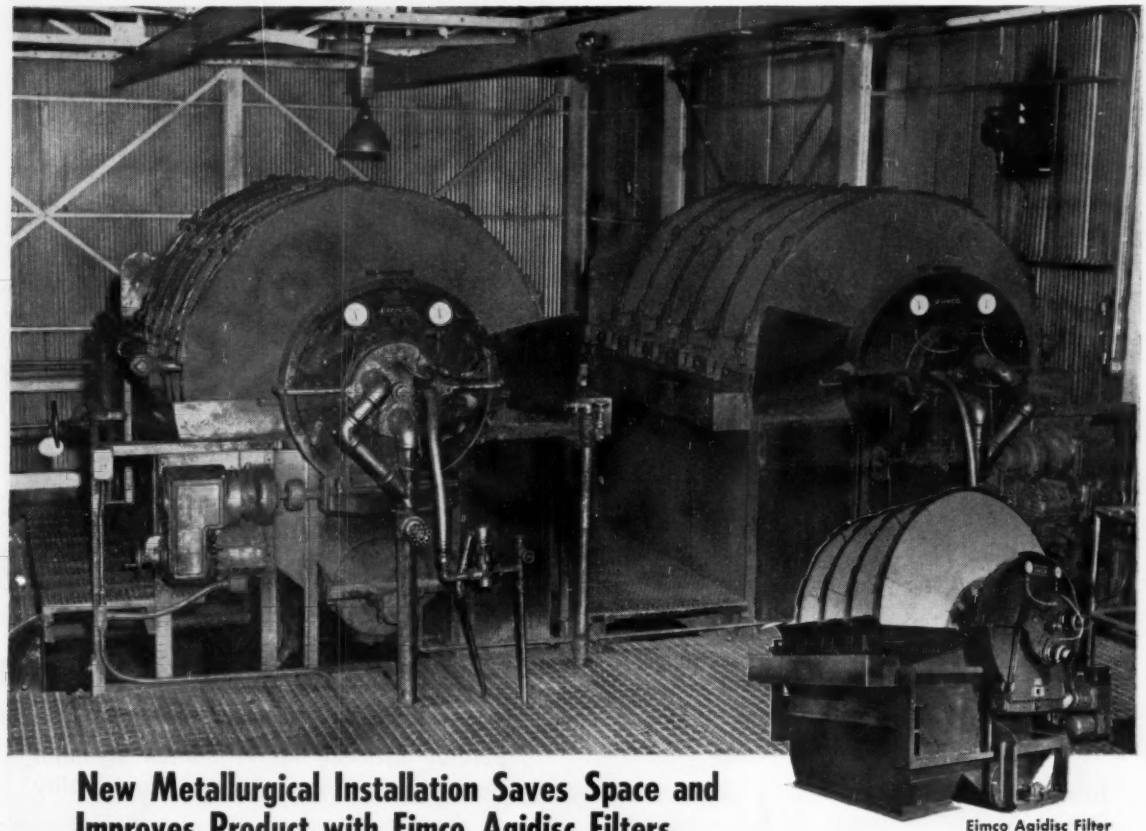
You can lubricate these bearings without dismantling motor. Pipe-tapped holes in the bearing housings at two points provide means for inserting new grease, flushing out old grease and of relieving pressure during re-greasing.

Look for the extra bolts on the end housing . . . the sign of greater value. Ask your Allis-Chalmers representative or Authorized Distributor to show you a cutaway section of this maintenance-cutting design. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 51B7225.

A-4616

ALLIS-CHALMERS

Circle 30A on reply card



Eimco Agidisc Filter

New Metallurgical Installation Saves Space and Improves Product with Eimco Agidisc Filters

The photo above shows an installation of two 6' diameter by 5 disc Eimco Agidisc Filters in their operating position in a new metallurgical concentrating plant.

These filters were installed as a result of the owner company and Eimco cooperation in a joint effort to improve the operation of the filter station at this plant and reduce moistures with the most economical equipment.

After the installation had been operating for six months the following data was made available.

		PREVIOUS EQUIPMENT	NEW EIMCO FILTERS
1.	Concentrate handled	350,000 lbs./24 hrs.	350,000 lbs./24 hrs.
2.	Labor required	1 man full time	1 man part time
3.	Attention required	Constant inspection	Periodical inspection every 6-8 hrs.
4.	Operating Capacity	Full load—no capacity for additional tonnage	½-¾ load—capacity for 33% to 100% additional tonnage
5.	Equipment	4—Drum filters (not Eimco)	2—6' dia. x 5 disc Eimco Agidiscs
6.	Filter area	621 sq. ft.	500 sq. ft.
7.	Floor Space occupied	416 sq. ft. filters only	189 sq. ft. filters only
8.	Cake Moisture	20%—21%	14%—15%
9.	% Moisture reduction over previous method		33%
10.	Filter rate increase over previous method		more than 15%

Eimco specializes in equipment to do a better job in filtration. Before you buy, take advantage of Eimco's experience in building filtration equipment for customers who look beyond first cost to get quality construction, individual design and guaranteed performance.

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Texas Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Pasadena, Calif. Houston, Texas London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

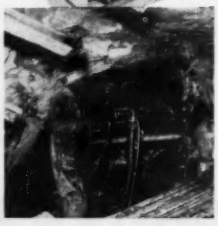
B-102

Circle 31A on reply card

TO DELIVER MAXIMUM POWER TO THE DRILLS

In rock drilling, pavement breaking and all other heavy-duty air tool operations, you can count on "Subway" (R) for uninterrupted delivery of full-capacity air pressure, and to stay on the job **longer,** regardless of the severity of the service. Despite its extra strength and durability, this "Standard of Quality" hose is light in weight, very flexible, easy to handle.

"Subway" (R) specifications include tough, oilproof black rubber tube; highest quality wrapped duck carcass; and a red rubber cover that offers longlasting resistance to the effects of severe abrasive wear and all conditions of weather. Made in sizes ½" to 1¼", I. D., in lengths up to 50 feet.



Contact Our Nearest Branch for Full Information on This and Other Goodall Rubber Products – Hose, Belting, Clothing, Footwear.

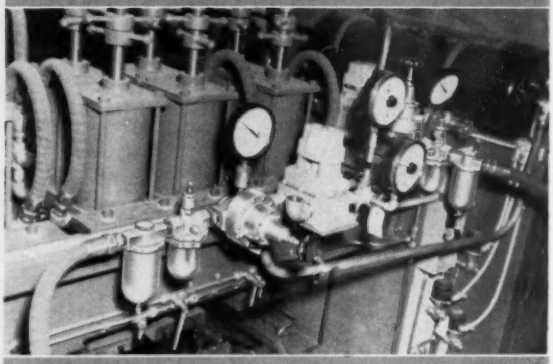
GOODALL RUBBER COMPANY

GENERAL OFFICES, MILLS and EXPORT DIVISION, TRENTON, N. J.
Branches: Philadelphia • New York • Boston • Pittsburgh • Indianapolis • Chicago • Detroit • St. Paul
Los Angeles • San Francisco • Seattle • Spokane • Portland • Salt Lake City • Denver
Houston • Goodall Rubber Company of Canada, Ltd., Toronto • Distributors in Other Principal Cities

Est. 1870

Circle 32A on reply card

how NORGREN air-pressure regulators improve machine performance, cut costs



Portion of a Sciaky Electric Resistance Welder, for welding automobile radiators, equipped with nine Norgren units. Norgren Lubro-Control Units filter the air, regulate the air pressure to 12 cylinders and provide oil-fog lubrication for cylinder walls and piston packing.

SCIAKY uses NORGREN pilot-controlled regulators on welders

provide accurate air regulation essential to produce uniform welds of high quality

Sciaky Bros., Inc., a world famous manufacturer of electric resistance welding machines, has used Norgren equipment since it started manufacturing in the U. S. in 1939. Every welder they produce includes some Norgren components... filters, regulators, lubricators or hose—sometimes up to 14 Norgren individual units on one machine.

Sciaky selected Norgren Pilot-Controlled Regulators because they provide the dependable, accurate air regulation necessary to produce uniform welds of high quality, and provide the large volume of air flow necessary to operate the many cylinders incorporated in their equipment.

The Series 20AC and 20AA Regulators were originally developed by Norgren for the welder industry. These pilot-controlled units provide extremely accurate pressure regulation, with high air flow capacities.

REGULATORS ESSENTIAL ON AIR-OPERATED EQUIPMENT

Norgren Pressure Regulators are being used on boring mills, air-powered pumps, pressure generators, presses, clamping cylinders, air chucks and many air tools. They pay for themselves in savings in air costs alone...and, provide accurate air regulation essential to high operating efficiency and long equipment life, with minimum maintenance costs.

WRITE FOR NORGREN BLUEPRINT 120

C. A. Norgren® CO.
3407 So. Elati, Englewood, Colo.

Oil Fog Lubricators
Air Filters
Pressure Regulators
Valves
Hose Assemblies

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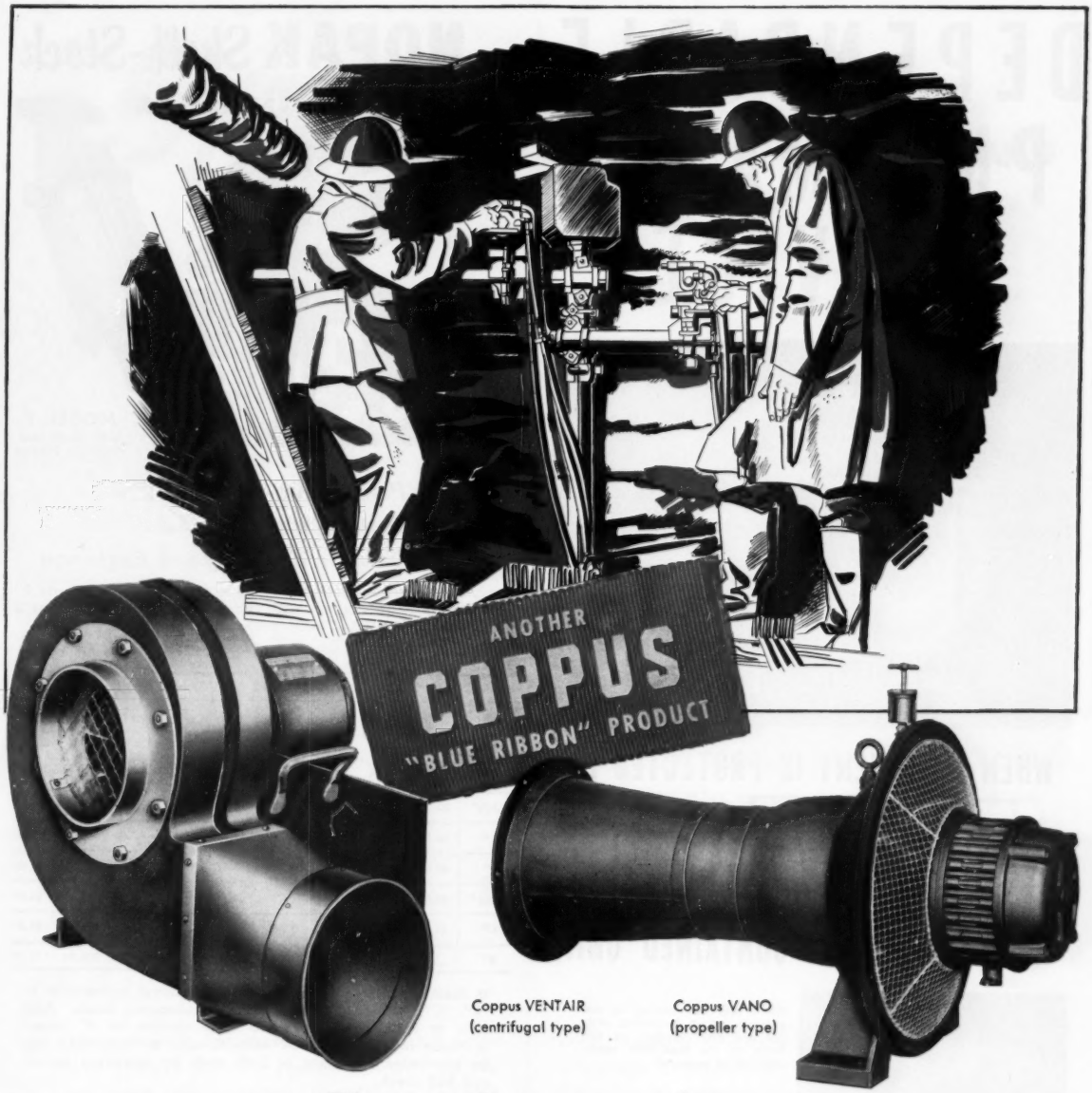


Coppus VENTAIR (centrifugal type)

Coppus VANO (propeller type)

Choose between them and get 30% to 100% more air

Coppus Blowers are designed for two different types of mine ventilation requirements: the centrifugal Coppus VENTAIR is for long pipe lines; the propeller-type Coppus VANO for shorter lines . . . the correct selection will give you from ⅓ more to twice as much air — for a given power consumption — than an ordinary all-purpose fan.

Available for either compressed air or electric motor drive, both can be used as blowers or exhausters and are obtainable in capacities up to 90,000 CFM.

Only Coppus makes both these types, one of which will give you better, more economical mine ventilation . . . know them by the "Blue Ribbon" that symbolizes the engineering and production skill behind every Coppus product.

Representatives listed in MINING CATALOGS. Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers and exhausters *for special purposes. See also THOMAS' REGISTER . . . Coppus Engineering Corporation, Worcester 2, Mass.*

COPPUS ENGINEERING CORPORATION
205 Park Avenue, Worcester 2, Mass.

Please send.....Bulletin 130

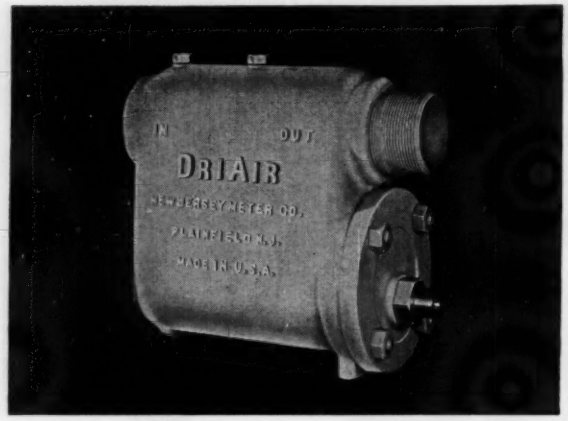
Name.....

Company.....

Address.....

Circle 34A on "reply" card

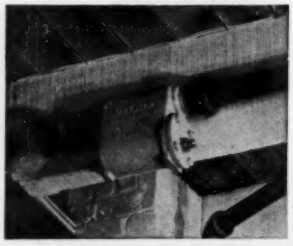
DEPENDABLE PNEUMATIC SERVICE



WHEN EQUIPMENT IS PROTECTED BY

DRIAIR

A COMPLETE SELF-CONTAINED UNIT



DriAir may be installed by suspending it from the piping, without any other support, or may stand on the floor near equipment being protected.

DRIAIR speeds production by separating and automatically ejecting the condensed water and oil from the air. DriAir collects dirt and rust from the air lines and delivers clean dry air to the tools, thus reducing wear and prolonging their life. All internal parts are made of bronze or copper—resistant to corrosion and practically permanent. Copy of Bulletin DA fully describing the operation of DriAir sent on request.

NEW JERSEY METER COMPANY

PLAINFIELD, NEW JERSEY

NOPAK Shelf-Stock Cylinders

- ***Low Prices but Top Quality***
- ***No Waiting for "Specials"***
- ***Less Design and Layout Expense***

Compare the prices and scope of NOPAK Shelf-Stock (1½ to 8" bore with 1 to 15" stroke) with competitive offerings and you'll specify these NOPAK Class 1 cylinders to cut costs.

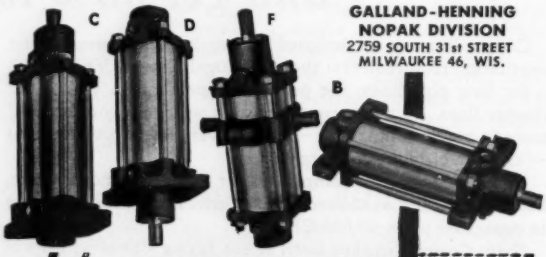
LIST PRICES F. O. B. Milwaukee, Wisconsin — Subject to Revision

Cyl. Dia. Bore ↓	STOCK STROKE LENGTHS — All Double Acting								
	1"	2"	3"	4"	6"	8"	10"	12"	15"
1½"	24.16	25.72	26.08	26.44	27.16	27.88	28.60	29.32	30.40
2"	26.24	27.88	28.32	28.76	29.64	30.52	31.40	32.28	33.60
2½"	32.36	34.12	34.68	35.24	36.36	37.48	38.60	39.72	41.40
3"	35.04	37.28	37.92	38.56	39.84	41.12	42.40	43.68	45.60
4"	40.84	43.68	44.52	45.36	47.04	48.72	50.40	52.08	54.60
4½"	48.96	51.92	52.88	53.84	55.76	57.68	59.60	61.52	64.40
6"	66.60	70.80	72.20	73.60	76.40	79.20	82.00	84.80	89.00
8"	____	126.80	129.20	131.60	136.40	141.20	146.00	150.80	158.00

● Basic mountings "A" and "E" (see above) convertible to "B", "C", "D", or "F" (see below) by changing heads. Add 10% to above list prices (no extra charge for 8" bore.) ● Piston rods have B-1, NF male thread. ● Cushioning can be eliminated on either or both ends by removing spring and ball-check.

NOTE: Class 1 cylinders listed, for Air or Oil to 300 psi. Water use requires 1 week delivery for chrome plating of steel components.

NOPAK 4-Way Valves (¼ to 2" IPS) hand, foot, solenoid or pilot operated, to actuate all cylinders, also in Shelf-stock.



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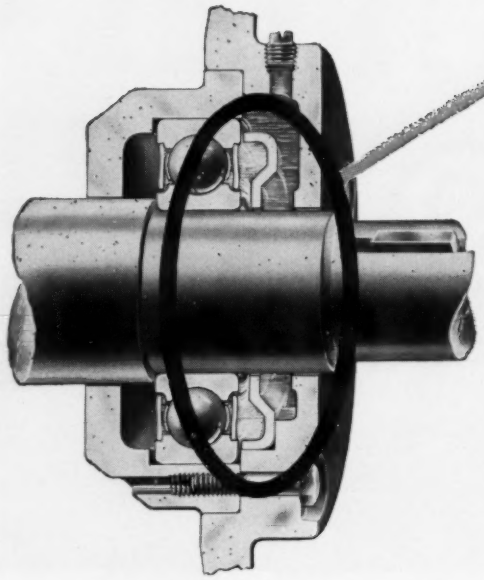

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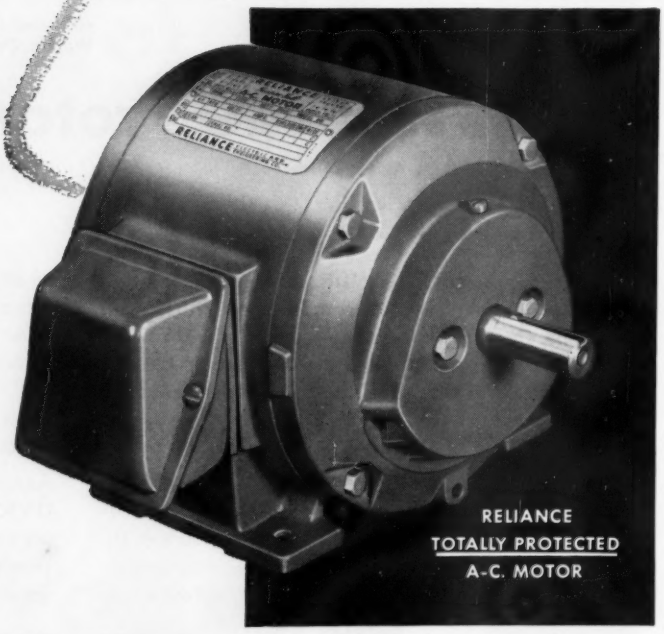

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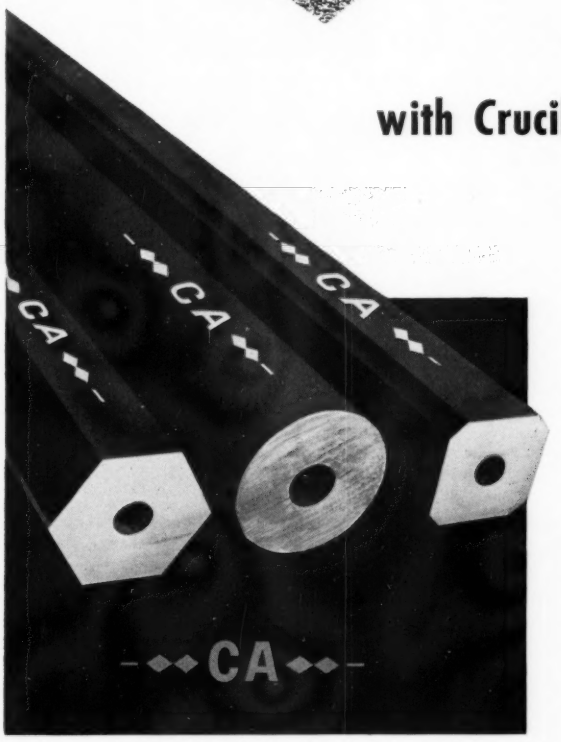

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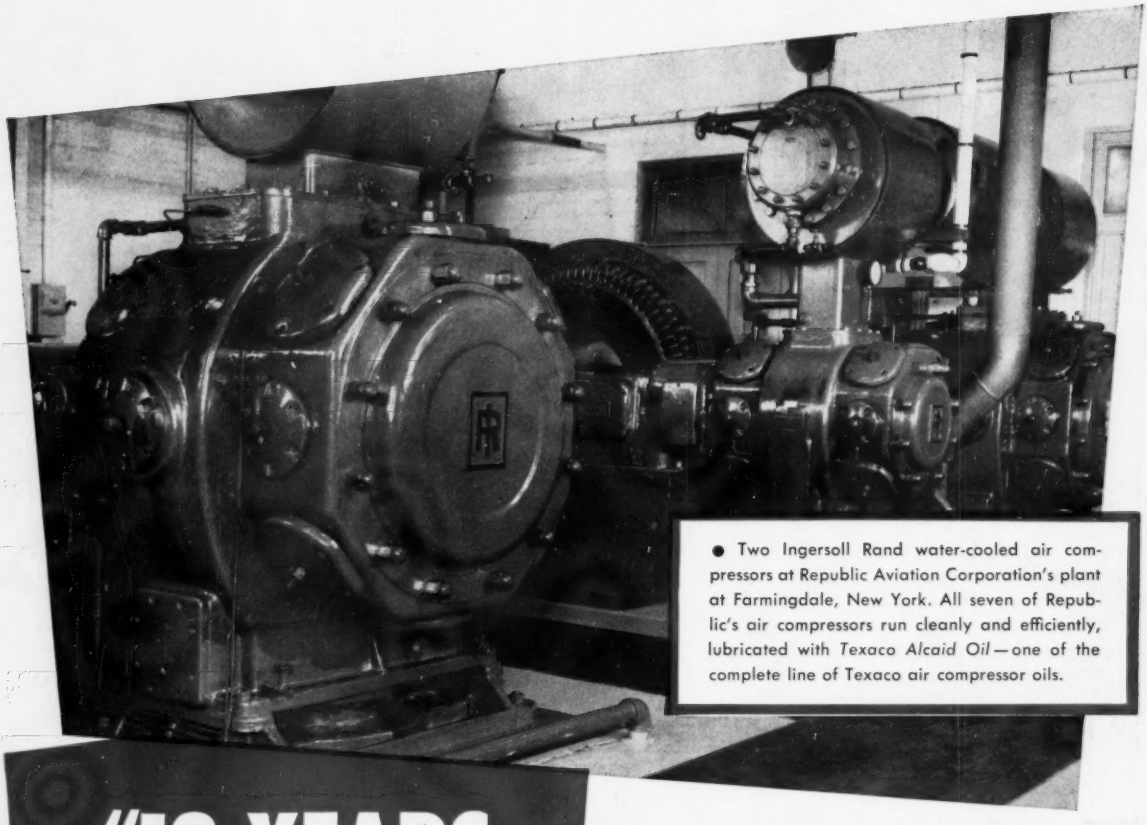

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